NURSING IN DISEASES

OF THE

EYE, EAR, NOSE, AND THROAT

BY

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PREFACE

In looking about for a book on Nursing which would serve as a text-book for the nurses in the Training-school of the Manhattan Eye, Ear, and Throat Hospital, we were unable to find one which seemed exactly adapted to our purpose.

A practical difficulty in the preparation of such a book arises from the fact that the preliminary education of nurses varies so greatly. For this reason, certain things which are too advanced for some are elementary for others. For example, an account of the action of antiseptics involves some knowledge of chemistry, and those nurses who have not had a course in chemistry are necessarily at a disadvantage.

Some may feel that the anatomic descriptions have no place in a book on nursing. We believe, however, that a nurse may be expected to know at least as much of anatomy as is usually taught in the text-books of the public schools and academies. We have attempted to present this part of the subject in a popular style.

We have tried to keep in mind that the book is intended for nurses and not for physicians, and have endeavored not to go beyond the capacity of the best educated nurses.

Our thanks are especially due to Dr. Edwin G. Zabriskie, Pathologist to the Hospital, for many photographs which he has taken for use in illustrating this book. We also thank those of the Hospital Staff who have kindly read the manuscript, proof, or who have offered suggestions.

The modern spelling of scientific terms has been adopted, in accordance with the usage of the majority of writers on scientific subjects.

NEW YORK CITY, *June*, 1910.

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I. General Part

CHAPTER I

GERM THEORY OF DISEASE

From the earliest times it was known that those who were exposed to certain diseases were liable to contract them. It was known that small-pox, measles, and scarlet fever were extremely contagious, while other maladies were less so. It was known that epidemics of various diseases, such as "plague," small-pox, cholera, yellow fever, typhus fever, typhoid fever, and many others, were liable to break out at irregular intervals in various parts of the world and very likely would destroy a large percentage of the population of the cities or villages affected. It was known that the cities were in more danger than the rural regions from these attacks, but even the villages were not exempt. For example, in the year 1721 Boston had an epidemic of small-pox, and out of a population of about 11,000 there were 5989 cases, with nearly 1000 deaths. About the year 1730 an epidemic of what was called "throat distemper" swept over New England, and in one village of about 140 inhabitants, 31, or more than one-fifth of the entire popu-

lation, died of the disease. Other villages had a similar mortality. The cause of such epidemics was absolutely unknown, but was generally thought to be a "miasma" or poisonous exhalation of the atmosphere. As an illustration of this, the word "influenza," the name of an epidemic catarrhal disease, means "influence," and was applied to the disease because it was supposed to be due to an occult atmospheric influence. The name "malaria" means "bad air."

The discovery of vaccination accomplished much in bringing small-pox under control, but even as late as 1869–73 a terrible epidemic of small-pox spread over Europe. Other diseases, such as cholera, typhus fever, and yellow fever, were held in check by the quarantine laws. The belief was quite general that there was very little hope of accomplishing much more than this in the control of epidemics until about thirty years ago, when it was discovered that certain germs were always associated with certain diseases; that the germs of one disease differed from those of other diseases; that if the germs of a given disease were injected into a guinea-pig or other animal, the disease would appear in the animal.

Since this discovery was made there has been a remarkable advance in the science of medicine. Not only has the association of germs with various diseases been established, but also the manner of transmission of the germs has been discovered in many cases. It has been learned that the germs of certain diseases are conveyed by insects, so that a mosquito that has drawn the blood of a person ill with malarial fever or yellow fever may carry the disease to others. Typhoid fever and cholera are conveyed by germs contained in the food and

drink. Here, too, insects, particularly the house fly, frequently convey the germs, but in many cases the spread of these diseases is due to pollution of the water-supply. The germs of the bubonic plague are conveyed by rats. A disease known as "sleeping sickness" has destroyed a large percentage of the population of certain parts of Africa. In the British protectorate of Uganda it is said that 200,000 people, or two-thirds of the population, have died of this disease since 1901. It has been discovered that in this disease there is always a parasite present in the blood, and that this parasite is carried to the victim by the tsetse fly.

The germs of many diseases are blown about in the air, so that it is impossible to know when one is in danger of contracting disease. It is found, however, that some are more liable to contract disease than others, and in most cases the disease does not follow, even though the germs are present. If this were not so we should all soon die of tuberculosis or other germ disease. We all have the power of resisting disease to a greater or less degree. Some have more resistance than others, and every individual has greater power of resistance at some times than at others. A physician or nurse may be exposed to a germ disease many times without taking the disease, but finally may succumb if exposed when fatigued by overexertion or loss of sleep. Anything which lowers the vitality, as, for example, the habitual use of alcoholic drinks, diminishes the resistance to disease. The mental state also has a great influence. It is an old belief, and undoubtedly well founded, that one who is afraid of a disease is much more liable to take it than one who is fearless.

The white corpuscles of the blood are believed to have the power of destroying disease germs which enter the body provided that the vitality of the body is kept up. These white corpuscles are, therefore, called "phagocytes," the meaning of which is "eating cells" or "devouring cells." In recent years it has been discovered that resistance to germs of tuberculosis is greatly increased by keeping the patient all the time in the open air. It will undoubtedly be found that many other diseases may be cured or prevented by the fresh-air treatment, simply because by this treatment the resisting power is increased.

Physicians are no longer afraid of such epidemics as formerly visited our large cities. Inspection of the water-supply and milk-supply has done much toward reducing deaths from typhoid fever. At Albany, New York, a system of filtration of the drinking-water was introduced about the year 1899. A comparison of the five-year period, 1894–98, with the five-year period, 1900–04, shows that the number of deaths per 100,000 from typhoid fever was, before filtration, 104; after filtration, 26. From diarrheal diseases, before filtration, 125; after filtration, 53. Of children under five years of age, before filtration, 606; after filtration, 309.[1] During the same two periods, at Troy, New York, only a few miles away, where the filtration system was not introduced, the death-rate remained practically unchanged. In Massachussetts the death-rate from tuberculosis is only about one-half as great now as it was in 1875. Probably there has been a similar reduction in the death-

[1] These statistics are taken from "Human Body and Health," Davison, published by American Book Co.

rate from tuberculosis in many other older States. In Havana, Cuba, where yellow fever had been present almost constantly from the earliest times, there has been no yellow fever, except isolated cases, for several years. In the Panama Canal Zone, where formerly, on account of tropical fevers, it was frequently fatal even to cross from ocean to ocean, the conditions have been changed by sanitary engineers, so that now the death-rate is very low. This has been accomplished by means of sewerage of towns, drainage of swamps, screening of the houses to keep out mosquitoes, and by other sanitary measures, all having for their object the destruction of the disease germs or making the conditions unfavorable for the development and transmission of the germs.

Contagious and Infectious Diseases.—Diseases which are transmitted by actual contact with a person affected with the disease, or by the use of the same articles, or by exposure to the breath or exhalations of the body, or to the effete matter given off in certain diseases, such as the membrane formed in diphtheria or the scales which fall from the skin after scarlet fever, are called contagious diseases. Infectious diseases, on the other hand, are those which are not conveyed directly from one person to another, as a rule, but are due to germs conveyed through the air, food, or water. Thus, many people may be ill at one time from typhoid fever because of pollution of their water-supply or milk-supply. It is possible to associate very closely with one who is affected with an infectious disease without any danger of contracting the disease. One may even sleep in the same bed and inhale the breath of a patient suffering with typhoid fever or malarial fever without taking these

diseases. Such diseases, therefore, cannot be called contagious diseases, although they are germ diseases. Some diseases are both contagious and infectious. Thus, tuberculosis may be taken by associating closely with a tuberculous person. Tuberculosis is, therefore, a contagious disease. It is, however, more commonly conveyed by means of germs blown about in the air; in milk from tuberculous cows; or in the meat from animals affected with tuberculosis. The disease is, therefore, according to our definition, also an infectious disease.

Epidemics.—Any disease which affects a large number of people in one locality at one time is called an epidemic. Epidemics may be either of contagious or infectious diseases. Epidemics disappear when the cause is removed or when all those who are susceptible have been attacked.

Endemic diseases, on the other hand, are those which are constantly present in certain localities on account of peculiar local conditions.

The term "zymotic" is a general term applied to all germ diseases. It is derived from a Greek word meaning "a ferment."

In surgery, too, the discovery of the germ theory of disease has caused a remarkable change in the methods used at operations; in the preparation of the operating rooms and of the patients; in the preparation of the surgeon and nurses, and of the instruments and dressings. It has rendered possible and safe many operations which, before this era, were regarded as dangerous or impossible. Previous to 1880 it is said that there were certain wards in Bellevue Hospital where operations of any kind were certain to be followed by erysipelas. Before the introduction of antiseptic methods, a wound in the knee-joint

was almost certain to be followed by infection, so that it would be necessary to amputate the leg. No surgeon was bold enough to do an abdominal operation except in an emergency, and then the results were frequently fatal. Operations on the eyes were frequently followed by severe inflammation and suppuration. Now all these operations are done with great safety, because it is found that the infection which formerly followed was due to germs, and that if the germs are kept out of the wound there will be no infection. Formerly the germs were frequently carried from one patient to another on the instruments. Now the instruments are carefully sterilized; that is, they are treated in a way which will destroy any germs which may be present. Other precautions which will be described later are taken to prevent the entrance of germs into the wound.

Previous to the discovery of the germ theory of disease epidemics were regarded as a great mystery, and all sorts of fantastic explanations were given to account for their occurrence. In the early days there was much superstition in the minds of the people concerning epidemics. The appearance of comets or meteors, the aurora borealis, or eclipses of the sun or moon were regarded as portents or warnings of coming disaster—perhaps epidemics; perhaps war. The position of the planets, and especially the conjunction of two planets, or of a planet with the moon, was believed to determine the time when and place where the epidemic would occur.

As science advanced it was hoped that chemic analysis would reveal something in the atmosphere which would account for the occurrence of epidemics. Careful chemic examinations were made of the air over malarial swamps, but nothing was found which was not present in the air everywhere.

The last hypothesis which was advanced previous to the announcement of the germ theory was that the occurrence of epidemics was governed by variation in the sun-spots. This explanation appears to have been satisfactory to many people.

In 1876 M. Louis Pasteur proved that the germs of the disease

of cattle, called anthrax, could be taken from an animal affected with the disease and cultivated outside the body of the animal, and then, if injected into another animal, the same disease would be produced. The full significance of this discovery was not realized at once. For years afterward many continued to hold the old belief that diseases were generated anew from atmospheric causes without any contact with those affected with the same disease and without the presence of disease germs. The following quotations from "Quain's Dictionary of Medicine," edition of 1884, will show the state of knowledge at that time:

Under the heading "Germs of Disease," p. 533, we read: "We must be on our guard against ascribing too general an influence to 'germs of disease.' In certain cases these may have been, in the first place, non-existent, as when such a disease has been 'autogenetic,' and in no sense a derivative of antecedent disease of the same kind. This caution is especially applicable in regard to such an affection as erysipelas, which, although certainly contagious, is also on very good grounds judged to be 'generable,' especially during certain states of lowered health induced by renal disease and some other visceral affections. Though not so certainly known, it is by many deemed probable that a similar caution may be necessary in regard to more general contagious affections, such as diphtheria, typhoid, typhus fever, and cholera, which though certainly contagious, may also be autogenetic. On this subject, however, much doubt and uncertainty still prevail."

Under the heading of "Periodicity in Diseases," in the same work, on page 1130, we read: "In these phenomena we have evidence of secular pathologic changes to which a clue is sought in studying their relation with secular meteorologic and telluric changes. In the epidemics of short recurring periods—the lesser epidemics, so to speak—it is becoming possible to construct a theory of recurrence, founded on the relationship of man to his physical and social surroundings, and the periodic changes which he and they undergo in common and in subordination to the periodic changes observed in Nature at large, and when the disease is communicable in relation to the number of susceptible people in a community. In the epidemics of long recurring periods—the greater epidemics—the same conditions obtain; but it would appear as if there were, in addition, some slowly developed cumulative influences at work, which manifest themselves only after long intervals of time. So far as these influences may consist in meteorologic changes, we look principally to India, where these changes are more uniform in their occurrence,

for the earliest clear light on the subject. There, for example, cholera is constantly present—now as a disease endemic to a particular region, now as a widespread epidemic within the limits of the peninsula, but ever and anon breaking its bounds and spreading pandemically throughout the world. James L. Bryden, M. D., has shown that the different developments of cholera within the boundaries of India have very definite relations to particular meteorologic phenomena; and it seems not unreasonable to suppose that, following the line of research inaugurated by him, in progress of time it will be possible to discriminate between the meteorologic changes which determine or concur with epidemic prevalence of the disease within India and those which determine or concur with wider extension of the malady, such as affected Europe in 1829–37, 1847–50, 1852–56, 1865–67, and 1869–73. Blandford's meteorologic researches promise much help in this direction, inasmuch as they are tending to show a close relation between the greater cycles of meteorologic change in India and cycles of meteorologic change in the sun's atmosphere, particularly as observed in the sun-spot period."

Again, under the head of "Epidemic," page 441, we read: "Much of the speculation as to epidemics which passes current for science at the present day is, in reality, an unsuspected continuation of the mystic teachings of earlier medicine, magnetism or electricity, for example, taking the place of Saturn or Mercury in the scheme of causation. The terminology is modernized, but the underlying conception remains the same. Again, the so-called 'precursors' of epidemics which still find a place in treatises on medicine are the relics of the doctrine of portents of the middle ages. They rest on the assumption of an epidemic being determined by some common extramundane or intramundane cause, of which it is but one of several effects. . . . For example, the earlier epidemics of malignant cholera which visited Europe were believed to have been heralded by an unusual prevalence of 'fevers' and of diarrheal affections. . . . In view of the extreme looseness with which the word epidemic is used in medicine, sometimes simply as a descriptive term, sometimes as a technical or quasi-technical term involving various hypothetic and theoretic conceptions inconsistent with each other, and sometimes as implying an occult influence, it would be well if it could be discarded from medical literature and language."

When it is borne in mind that this edition was published only twenty-five years ago and that the writers were men of the highest

medical authority of that time, we can realize how recent is the knowledge of the germ theory of disease.

In "Appleton's American Cyclopedia," edition of 1883, under the heading of "Malaria," we read: "Malaria (Ital., mala aria, 'bad air') or marsh miasm, an emanation which produces in mankind intermitting and remitting diseases. This poison is not cognizable by the senses nor can it be detected by chemical tests; it is known only by its effects. The concurrence of vegetable matter susceptible of decay, of moisture either on the surface or a short distance below it, and of a certain elevation of temperature, is necessary for its evolution; of these, long-continued heat has the greatest influence in increasing the intensity of the poison."

The presence of the *plasmodium malariæ* in the blood of patients suffering with malarial fever had been announced by Crudeli and Klebs previous to that time, but the importance of the discovery was evidently not appreciated.

The effect of the germ theory was felt in surgical practice somewhat earlier than in medical practice, for the reason that the researches and experiments of Sir Joseph Lister, begun as early as 1865, proved that micro-organisms are always present in fermentation, decomposition, and putrefaction, and that these processes could be prevented or stopped by any means which would prevent the production of germs. He was the first to apply this knowledge to the treatment of surgical cases and to perform surgical operations under conditions of asepsis. He was also the first to demonstrate the value of carbolic acid as a germ destroyer. The results which he obtained in his operations were so much better than those obtained under the old methods that within a few years surgeons generally were convinced of their value, but so late as 1885 or even later there were some who were unconvinced and who scoffed at antiseptic precautions.

CHAPTER II

ANTISEPTICS

THE word "antiseptic" is defined in the Century Dictionary as "anything which destroys the micro-organisms of disease, putrefaction, or fermentation, or which restricts their growth and multiplication."

The word antiseptic is also used as an adjective, as, for example, we speak of an antiseptic application or an antiseptic wash. The noun, "antisepsis," means the exclusion, especially from a wound, of the germs which, if allowed to enter, would produce septic infection or blood-poisoning. Thus we may say "a great revolution in the management of wound infection has been brought about by *antisepsis*."

Asepsis, on the other hand, means freedom from harmful germs. It must always be borne in mind that there are many more harmless germs than harmful ones. The harmful germs are the germs of disease, of suppuration, of putrefaction, and sometimes of fermentation. A wound is said to be "aseptic" when such precautions have been taken that it is believed that no germs of suppuration are present. It is possible that a wound may be aseptic even when no such precautions have been taken.

The word "sepsis" is from a Greek verb which means "to make putrid."

In this chapter it is not the intention to make a list

of antiseptics, but to describe a few of them and explain the principles upon which their action depends.

Heat.—Up to a certain point the development of germs is favored by heat. At the freezing-point of water germs remain dormant, but as the temperature rises the development is more rapid until the temperature of about 100° F. is reached. Above this point, as the temperature rises, the growth becomes less rapid, and at 155° F. most germs are destroyed. For this reason milk which has been kept at a temperature of 155° F. for thirty minutes will keep for days without souring. Milk thus treated is said to be "Pasteurized." At the temperature of boiling water (212° F. or 100° C.) all fully developed germs are destroyed. The spores from which the germs develop, however, are not destroyed by a short exposure to this temperature. To make certain, therefore, that all spores are destroyed, it is customary to keep a solution which is to be sterilized at a temperature of 212° F. for twenty minutes. This will destroy all germs, but not the spores from which the germs develop. After allowing the spores to develop for twenty-four hours the solution is again heated to 212° F. for twenty minutes, and sometimes the same is repeated after another interval of twenty-four hours.

Heat, therefore, in the cases where it can be applied is one of the most effective antiseptics which we have. Heat is available for sterilizing instruments, bandages, and dressings. Bedclothing and wearing apparel may also be sterilized by heat, and thus the spread of contagious diseases may be prevented. The heat may be either dry or moist. The articles to be sterilized may be put in boiling water, in steam, or in an oven or room heated

above 212° F. The effect upon the germs will be the same in any case, except that with dry heat a higher temperature is required.

In many cases, however, it is obvious that heat sufficient to destroy germs cannot be used without doing serious damage. The highest temperature at which an application may be made to the body without danger of scalding is not much above 120° F., and this temperature, as before stated, is very favorable for the multiplication of germs.

Cold is an antiseptic, not in the sense that it will destroy germ life, because most germs may be actually frozen in a solid block of ice, but when the ice is melted and the temperature raised to the proper point it will be found that the vitality of the germs has not been impaired in the least. Still, as stated in the previous section, a low temperature is unfavorable to the multiplication of germs and, therefore, cold applications are very useful in the early stages of such diseases as purulent inflammations of the eyes or in other parts of the body where there is inflammation with threatened formation of pus.

Antiseptic Solutions and Chemic Antiseptics.— There are many solutions which are used for the destruction of germs or to retard their multiplication. These differ much in strength and efficiency. Some knowledge of the properties of the various antiseptics is necessary in order to select the one best adapted to a given case. An antiseptic which is most effective for destroying germs may not be suitable for sterilizing instruments, because it would dull the edge or destroy the polish of the surface, and so cause the instrument to rust. Some antiseptics are unsuitable for sterilizing clothing because

they would injure the fabric or destroy the color. Many very efficient antiseptics must be used with great caution on the human body for fear of poisonous effects or of local damage. Many antiseptics may be used on the surface of the body which could not be used in the eye, the throat, or an open wound. It is necessary, therefore, to consider not only whether an antiseptic is an efficient germ destroyer, but whether it can be safely applied for the purpose desired.

The following are some of the commonest antiseptics:

Bichlorid of Mercury.—This is a powerful antiseptic. Germs cannot live long in a solution containing 1 part of bichlorid of mercury in 10,000 parts of water. Stronger solutions act more quickly in destroying germs, but have the disadvantage of being irritating to the skin in proportion to the strength. For this reason bandages sterilized with bichlorid of mercury cannot be used on patients who are susceptible to this irritation. Knives cannot be sterilized with it because they will be dulled and rusted. The albumin in the tissue is coagulated by it, so that it acts only on the surface, and germs inclosed in the albumin may escape unharmed. Moreover, the drug is a deadly poison and must be kept out of the way of children or of anyone who might swallow it by mistake. To avoid accidents of this kind the drug is frequently made up into tablets which are colored, so they may not be mistaken for anything else. The solution made from these tablets takes the same color.

Carbolic Acid or Phenol.—The pure carbolic acid is in crystalline form at the ordinary temperature of the air. The crystals may be liquefied by heating, but will immediately become solid crystals again when cooled.

On adding a small quantity of glycerin or water they are liquefied and remain so at the ordinary temperature of the air. A solution of 1 part of carbolic acid in 40 parts of water (*i. e.*, a 2½ per cent. solution) will destroy all germ life in a very short time. It should be remembered that in using antiseptics, the stronger the solution the more quickly will germs be destroyed, but in many cases it is practically better to use weaker solutions and allow a longer time, especially when the antiseptics are to come in contact with the body. Carbolic acid in solution of 1 part in 20 is sometimes used for sterilizing instruments, but the instruments must not be allowed to remain more than a few minutes in the solution, and then should be dipped in boiling water or they will soon rust. Carbolic acid acts as a local anesthetic. If the hands are held in a weak solution for a short time a numbness will be noticed. A strong solution of carbolic acid acts as a caustic. It will be noticed, therefore, that the same chemic substance may act in several different ways, depending upon the strength of the solution. Thus, carbolic acid is an antiseptic in any strength, but it may also be a local anesthetic, an irritant, or a caustic. Carbolic acid has an advantage over bichlorid of mercury in that it does not coagulate the albumin of the tissue, and, therefore, penetrates more deeply.

Chlorin.—The action of chlorin is quite different from that of carbolic acid or of bichlorid of mercury. It is, like them, poisonous to germs, but it has also a chemic action upon the tissues and especially upon diseased or dead tissues. Most of the tissues of the body are very complex in their chemic composition. The complex molecules are very readily broken up under the action

of chemic agents. As a rule, the more complex the molecule, the more readily it is broken up. The molecules of albuminoids or proteids, which form the chief part of the solid constituents of the blood, muscles, nerves, brain, and many other organs of the body and also the entire substance of all forms of germs, are exceedingly complex. The molecule contains carbon, hydrogen, oxygen, nitrogen, and sulphur, and each molecule contains altogether perhaps more than 200 atoms of these various elements. If any one of the atoms is removed the molecule is immediately destroyed, and in case it was contained in living tissue the part of the tissue affected is destroyed. It is found that chlorin has a very strong affinity for hydrogen, and as soon as chlorin comes in contact with hydrogen the two unite to form hydrochloric acid. When chlorin comes in contact with one of the complex molecules of proteid substances it has no difficulty in abstracting the hydrogen and thus destroying the molecule. Decomposing organic matter generally has a foul odor, and this odor is destroyed by the action of chlorin because the chlorin breaks up the molecules which produce the bad odor. The effect of chlorin in bleaching fabrics is due to a similar action. The coloring-matter contains hydrogen. This is removed by the chlorin and the color disappears. If cloth remain long in contact with chlorin not only is the coloring-matter attacked, but also the hydrogen is drawn from the molecules of the fabric itself and the fabric is weakened. The union of the chlorin with the hydrogen taken from the tissues forms hydrochloric acid, which itself is a powerful antiseptic. A second way in which chlorin acts is that the chlorin or

a part of it may unite with and become a part of the molecule with which it is brought into contact. A third way in which chlorin acts will be described under the heading Oxidizing Agents.

Preparations Containing Chlorin.—The officinal preparation of chlorin-water contains $\frac{4}{10}$ of 1 per cent. of chlorin. This is a powerful antiseptic, but must be freshly prepared, as the chlorin soon unites with the hydrogen of the water, forming hydrochloric acid.

Chlorid of Lime.—"A compound resulting from the action of chlorin upon hydrate of calcium and containing at least 25 per cent. of available chlorin" (United States Dispensatory).

Chlorinated Soda (Liquor Sodæ Chloratæ or Labarraque's Solution of Chlorinated Soda).—This is a "clear pale-greenish liquid of a faint odor of chlorin, a disagreeable alkaline taste, and an alkaline reaction. The strength corresponds to at least 2 per cent. of available chlorin" (United States Dispensatory).

Bromin.—"Bromin is a volatile liquid of a dark red color when viewed in masses; hyacinth red, in thin layers. Its taste is very caustic and its smell strong and disagreeable, having some resemblance to that of chlorin" (United States Dispensatory).

Bromin as an antiseptic acts in a precisely similar manner to chlorin, but not so powerfully.

Oxidizing Agents

Hydrogen Peroxid.—In this we have an example of still another class of antiseptics. It is a law of chemistry that when oxygen is set free from any combination it is very active and ready to enter a new combination with

another element. In this state it is spoken of as "nascent oxygen." Hydrogen of peroxid consists of two atoms of hydrogen united with two atoms of oxygen. This is represented by the symbol H_2O_2. This very readily breaks up into water (H_2O) and oxygen (O). The oxygen thus set free attacks anything with which it can unite. When brought into contact with complex organic molecules this free oxygen may unite with the hydrogen or with the carbon in the molecule. In either case the molecule is broken up and destroyed. Thus, when hydrogen peroxid is brought into contact with pus, the pus-cells are attacked by the nascent oxygen and are destroyed with a great bubbling, due to the escape of gases as the cells are broken up. The union of oxygen with another element is called oxidation. Anything which sets oxygen free so that it can so unite is called an oxidizing agent.

Chlorin also acts sometimes as an oxidizing agent. Instead of taking hydrogen from an organic molecule, as described in a previous section, it may attack the hydrogen in water and form hydrochloric acid and set free the oxygen of the water, which will act in the same way as the oxygen set free from hydrogen peroxid, attacking and destroying the molecules of organic matter, especially of dead organic matter.

Bromin and **iodin,** which are very closely related to chlorin in chemic behavior, also act in the same way as oxidizing agents.

Permanganate of potash is a very powerful oxidizing agent. When brought into contact with organic substances it readily gives up its oxygen, which attacks the organic matter in the way previously described.

Reducing Agents

These act in a manner opposite to that of the oxidizing agents. Instead of setting free oxygen, which may attack an organic molecule and unite with its hydrogen or carbon, a reducing agent extracts oxygen from substances with which it comes in contact. The result, however, is the same as far as the destruction of the organic matter is concerned. For example, when hydrogen peroxid comes in contact with coloring-matter, the oxygen in the hydrogen peroxid unites with the hydrogen in the coloring-matter and the coloring-matter is destroyed. On the other hand, when sulphurous acid comes in contact with the coloring-matter the coloring-matter is destroyed just as effectively, but instead of taking out the hydrogen it takes out the oxygen. In either case the molecule is broken up and destroyed.

The chemic reactions which occur when sulphur is burned in the presence of oxygen or air are very complex, but, in brief, it is sufficient to say that in burning, the sulphur unites with the oxygen of the air, forming sulphurous oxid (SO_2). This then unites with the water in the air, forming sulphurous acid ($SO_2 + H_2O = H_2SO_3$). When the sulphurous acid comes in contact with organic matter it extracts oxygen, forming sulphuric acid ($H_2SO_3 + O = H_2SO_4$). It is this last change which causes the bleaching which is seen when colored articles are exposed to the fumes of burning sulphur.

CHAPTER III

DISINFECTION OF ROOMS AND CLOTHING

THE nurse need scarcely be told that disinfection of rooms occupied by persons suffering from a contagious disease is one of the chief means by which the spread of such a disease is combatted. It may be remarked here that the matter is simplified very materially if, previous to its occupancy by such a patient, the room has been prepared in a proper manner. Thus, all ornaments, pictures, and unnecessary furniture should be removed, all closets should be emptied. Such furniture as remains should be simple, free from upholstery, and easily cleaned. The carpet should be removed, although a small rug may be allowed to remain on the floor; hangings should be taken down, and the woodwork, closets, walls, and ceiling thoroughly scrubbed with soap, washing soda, and water, special attention being given to joints, corners, and crevices.

During the patient's occupancy of the room care must be taken, above all else, to secure free ventilation into the open air, in order not only that the patient may have pure air to breathe but also that the pathogenic organisms created by the disease may not be confined in the room. In diseases in which these organisms are given off in large quantities in the sputum, urine, or feces, these discharges must be disinfected promptly by a germ-

destroying solution placed in their receptacles. For this purpose chlorinated lime possesses many advantages over any other germicide. Carbolic acid and formaldehyd may also be used. The clothing of the patient and the bedclothing must be frequently changed, and that which is removed should be immersed in a 5 per cent. solution of carbolic acid for two or three hours; boiled for half an hour, and then washed thoroughly with soap and warm water. In addition, the room itself must be kept scrupulously clean.

When the patient has recovered from his disease, and it is desired to make use of the room occupied by him for its customary purposes, it must undergo disinfection. This applies also to the furniture, bed-linen, and clothing which it may have contained. If the precaution has been taken to properly prepare the apartment beforehand, as suggested above, this cleansing becomes a very easy matter. The first thing to be accomplished is the destruction of the germs of the disease, after which the room and its contents must be cleaned. In the case of the bedding, clothing, etc., disinfection should be by steam heat, if possible, the materials being left in the chamber of the steam sterilizer for half an hour or more. When such an apparatus is not available, the articles should be immersed in a 2 per cent. solution of carbolic acid for two hours, then boiled for thirty minutes, and subsequently washed. Fine fabrics, mattresses, or other articles which cannot be treated in this manner, may be hung upon a line in the room about to be disinfected; or, in cases of severe infection, they should be burned.

The use of formaldehyd, either in a watery solution

or vaporized, has almost entirely superseded sulphur for disinfecting purposes, as it is the most reliable germicide known. It does not affect either the color or structure of clothing, and its vapor mixes readily with the air, penetrating loose materials much more deeply than any other germicide. Its effect is more potent if the air of the apartment is moist and warm. If the formaldehyd is to be applied in watery solution, an atomizer is employed, and a 20 per cent. solution of the drug is sprayed upon all the surfaces in the room, which is then closed for twenty-four hours. In the case of rooms not absolutely bare, those containing bedding, clothing, furnishings, etc., the vapor of formaldehyd must be used. Appliances for generating this vapor may be had at establishments dealing in hospital supplies. Windows, doors, chimneys, ventilators, and other openings should be tightly closed—either by packing the openings with cotton, sealing them with gummed paper, or strips of newspaper pasted with ordinary flour paste—closet doors and bureau drawers should be opened, and the air of the apartment made to contain at least 1 per cent. of formaldehyd gas. When this is accomplished, the room must be closed for twenty-four hours, after which it is opened, ventilated, and thoroughly scrubbed with soap, water, and washing soda.

Where sulphur is used the same precautions as to tightly closing every crevice in the room must be observed and sulphur candles, which burn for two hours, giving off dense fumes of sulphurous acid, may be employed. The room must be kept closed for eight hours, and when reopened all woodwork should be washed with a 1 : 1000 solution of bichlorid of mercury, the wall paper should

be removed, and the plastered surfaces freshly kalsomined. As before remarked, sulphur is not as efficient as formaldehyd, and, moreover, it possesses the disadvantage of discoloring metals unless oiled, and acts injuriously upon clothing and organic material generally.

CHAPTER IV

STERILIZATION

Sterilization of the Hands

Of the various acts in the preparation for an operation, none is more important, as far as the nurse is concerned, than the sterilizing of her hands and arms, and in order that this may be as uniformly thorough as possible some established method should be rigidly followed at all times. Nothing can excuse a nurse for the omission of any part of this routine. The surgeon may be, and unfortunately, sometimes is, careless about such matters—or, at least, seemingly so—but his is the reponsibility; the nurse cannot assume any such responsibility, but must observe to the smallest detail the method laid down for her guidance. It may be pointed out also that in operations upon the eyeball the surgeon practically never touches the part operated upon; while in operations upon the ear, nose, or throat he frequently wears gloves. The nurse, on the other hand, may be called upon to handle dressings, sponges, etc., with or without gloves, and, consequently, must always have her hands in an absolutely sterile condition. Moreover, it cannot be too often repeated that if, during the course of an operation, or at any time after she has once gone through the process of "scrubbing up," the nurse's hands or arms should become contaminated through com-

ing in contact with an article of furniture, clothing, or other unsterile object, she must again wash them in an antiseptic solution and rinse them off thoroughly afterward. Contamination with actually infectious material, such as vomited matter, secretion from the patient's mouth, etc., demands the repetition of the entire disinfecting process before the nurse may again essay her rôle as an assistant at the operation.

There have been a great variety of methods of sterilizing the hands and arms put forward by surgeons from time to time, a few of which may be regarded as standard methods and will be mentioned. In all, the first step consists in thoroughly scrubbing the hands and forearms with warm water and Castile or tincture of green soap for five minutes. Special attention must be paid to the finger-nails, which should be kept short with the edges filed, the nail-brush being used vigorously. The soapy solution is then removed by thoroughly rinsing the hands and arms in warm water or alcohol. So far, all methods agree. With regard to the subsequent procedure, that most commonly followed is to immerse the hands and arms in a solution of the bichlorid of mercury, 1 part to 1000 parts of water. This substance is one of the most powerful germicides known, and solutions containing it are easily prepared, but it possesses the disadvantage of being very irritating to the skin of many individuals, who, consequently, favor some other antiseptic solution. Bichlorid of mercury is also readily precipitated by soap; hence the necessity for thorough rinsing of the arms and hands before immersing them in the bichlorid solution. This immersion should last for at least three minutes, after which a second rinsing should follow in sterile

water, the hands and arms being then dried on a sterile towel.

As a substitute for bichlorid of mercury for cleansing the hands and arms, *lysol*, in a 2 per cent. solution, is sometimes used. It possesses a slightly soapy character, does not irritate the skin, and is a powerful germicide, thus making an excellent hand solution.

Disinfection by *lime and soda* is also frequently employed. This method consists in covering the hands and forearms with a thin paste made of chlorid of lime and carbonate of soda, and after a few minutes washing it off in sterile water or weak bichlorid solution.

The *potassium permanganate and oxalic acid* method may also be mentioned, although it has fallen into disuse of late years. After the preliminaries mentioned above, the hands and arms are immersed in a saturated solution of potassium permanganate until they are stained a mahogany brown; they are then put into a saturated solution of oxalic acid until all the color has vanished. Finally, they are rinsed in sterile water or weak bichlorid solution.

Sterilization of Dressings and Bandages

Operation wounds may be contaminated or rendered "septic" through the instruments, the hands of the operator or assistant, or the dressings. The necessity for absolute "surgical cleanliness" of the hands and arms has been emphasized. No less thorough must be the preparation of the dressings and instruments which are to come in contact with the wound or its immediate surroundings. All towels, gowns, dressings, bandages, sponges, cotton pledgets, suture material, ligatures,

nail-brushes, etc., are to be sterilized by being subjected to the influence of hot steam in closed chambers. There are many varieties of apparatus for sterilizing with steam, of which the one shown in Fig. 1 may serve as an example.

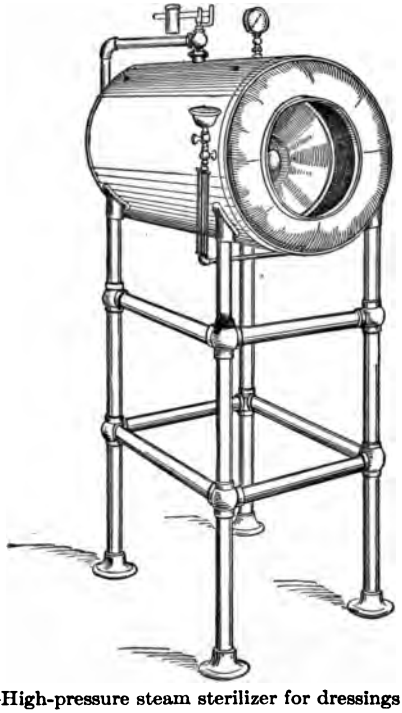


Fig. 1.—High-pressure steam sterilizer for dressings (Ashton).

After having been saturated with superheated steam for half an hour the dressings should be kept in closed metallic receptacles until about to be used. They are then removed with sterile forceps or clean hands as required. Dry heat, which was formerly used for sterilization purposes, has been almost entirely aban-

doned, as it requires very much longer to do the work by that method, and also because the penetrating power of dry heat is much inferior to that of steam, and, consequently, as a germicide it is distinctly less efficient. When a steam sterilizer is not available, reliance must be placed upon boiling the articles to be used for thirty minutes, which will render them aseptic.

Sterilization of Instruments

There remains to be considered the preparation of the instruments for an operation. Modern practice demands that all surgical instruments shall be of the simplest possible description, unnecessary angles being avoided, and instead of screws to join different parts of scissors and such instruments, a simple locking arrangement is used. This facilitates cleaning and decreases the likelihood of the formation of rust. The handles are of aluminum or other metal, nickeled and polished. Fine cutting instruments are kept in racks, which secure the handle and leave the points and cutting edges free. The nurse must learn to handle the more delicate instruments, such as cataract knives, keratomes, etc., with extreme care, as their keenness must be preserved, and, moreover, they are expensive. Consequently, they must not be dropped carelessly into a sterilizer, but first placed in a rack, such as is referred to above, and then immersed in the sterilizing solution. This is usually a 1 per cent. solution of sodium carbonate, which prevents rusting. Some surgeons advocate dipping the instruments then into alcohol (95 per cent.), but many content themselves with boiling the instruments, after which they are removed with sterile forceps to a suitable

tray covered with a sterile towel. Prolonged boiling has the effect of dulling the keen edge of very fine knives, which, therefore, may be dipped several times into the boiling solution and subsequently into alcohol, and gently dried with sterile gauze, care being taken that no filaments of the cotton remain adherent to the knife-blade. Finally, should an instrument become contaminated previous to or during an operation by coming in contact with any object not sterilized, as, for example, the hair or beard of the patient, it must, of course, be at once resterilized by the nurse before being again employed.

CHAPTER V

PREPARATION OF OPERATING ROOM

In a private dwelling the room selected for an operation should be the largest one situated at a convenient distance from the patient's bedroom. The facilities for ventilating the room and the available source or sources of light should be carefully studied. Electricity is the best artificial light, on account of the ease with which it may be brought close to the patient and directed upon the field of operation by means of a shade or reflector, or made use of in the form of a head-light with mirror to be worn by the surgeon. Where electricity is not available, however, the lights from ordinary illuminating gas (the burners being provided with incandescent mantles, if possible, and a reflector), or, failing this, from a kerosene lamp, or, finally, from the acetylene flame of an ordinary bicycle lamp, may be utilized. In many eye operations a good light from a window is entirely satisfactory, especially if the window is so situated that the light will fall upon the side of the patient's face. In others, however, a thoroughly concentrated light is needed, and in these cases reliance should be placed upon an artificial illuminant. It may be said that in all nose, throat, and ear operations artificial light is necessary; one of the favorite means of providing it being the head-light worn by the surgeon and obtaining its electricity from the street current or from a

storage-battery. Should it be found necessary to rely upon the unprotected flame of some form of gas or kerosene lamp, strict attention must be paid to the ventilation of the room. If ether is to be used as an anesthetic, it is exceedingly dangerous to allow the ether vapor to come in contact with an uncovered flame, as the vapor is highly inflammable. Cases of serious injury from neglect of proper precautions in this matter have been reported. Should chloroform be the anesthetic chosen, and no electricity be available for lighting purposes, arrangements must be made for free direct ventilation into the open air, as a burning flame in a room into which chloroform vapor is being liberated produces fumes which are exceedingly irritating and even dangerous to those who must breathe them. Briefly, it may be said that the matter of the source of light, the anesthetic, and the means of ventilating the room should always be discussed with the attending surgeon beforehand, so that there may be no confusion at the time of operation. The nurse should be fully informed upon this matter, and may quite properly call the attention of the attending surgeon or his assistant to the subject if she has not already been instructed.

Having selected a room, the question of its preparation for the operation will depend upon the length of time elapsing before the operation is to be performed. Thus, if the time be an interval of a day or two, it is best to remove all hangings and such articles of movable furniture as are not to be used, and to thoroughly scrub the walls and floors. Should, however, but a few hours remain before the room is to be made use of, it is safer to disturb nothing—not even sweeping the floor. In-

stead, all pictures, hangings, and large furniture should be covered with sheets wrung out of boiling water or a solution of bichlorid of mercury (1: 1000). The floor should be similarly covered, and under the sheets about the operating table should be spread newspapers or heavy paper to prevent damage by blood or irrigating fluids. Sheets should be pinned or tacked to the side walls to a height of 5 or 6 feet from the floor.

A long, narrow, strong table (usually the kitchen table or ironing table) may be used as an operating table. This should be covered with a folded blanket over which a rubber sheet and a clean linen or cotton sheet should be spread. A folded blanket and sheet should be placed at the foot of this table in readiness for covering the patient. At the head, a firm head-rest should be provided. This can be made by rolling a bath towel to form a pad and pinning it firmly, or by rolling a sheet and pinning it in a towel.

Two small tables should be provided: one for instruments, the other for sponges, dressings, solutions, etc. The size of these tables will be determined by the character of the operation. Eye operations require very small space for instruments and dressings as compared, for instance, with mastoid operations, in which ample space is needed for a large array of instruments, dressings, solutions, etc. A small table accommodates the instruments and sponges necessary in a tonsil and adenoid operation, while a large space is necessary for those required in operations on the accessory sinuses. In addition, a small table and a low chair or piano-stool should be provided for the anesthetist. All of these tables should be covered with sheets or large towels, over which sterile

towels should be spread, as the instruments and dressings are laid out.

In operations requiring a general anesthetic there should be provided an emergency table for hypodermoclysis, intravenous infusion, and hypodermic injection. This table should contain, according to the nature and situation of the operation to be performed, a selection of

Fig. 2.—Emergency table.

the following articles and solutions: A saline or stimulating enema, solutions of hydrogen peroxid, adrenalin, tannic acid, and gallic acid; a croup tent, tonsil clamp; tracheotomy set; ampoules for inhalations; an oxygen tank (Fig. 2).

That no time may be lost when haste is essential, the solutions for hypodermic use should be in large-necked bottles, covered with sterile rubber and sterile

needles in the rubber. For intravenous infusion, instruments should be sterilized and ready, and suture material and dressings in sterile packages laid out on the table. If carefully done up, these will not need to be frequently sterilized.

In an adjoining bath-room, if possible, at any rate where running hot and cold water are available, preparation should be made for the surgeon and assistants to sterilize their hands. For this procedure the following articles are essential: Several cheap nail-brushes and wooden nail-picks (orange sticks) which have been sterilized by boiling twenty minutes; 8 ounces of tincture of green soap; a small basin or bowl containing 95 per cent. alcohol; two large basins or bowls, one containing 1 : 1000 solution of bichlorid of mercury, the other, sterilized water. Other solutions, such as lysol and carbolic acid, may be required by the surgeon, but need not be provided unless requested.

The surgeon usually brings his own sterile gowns, rubber gloves, towels, dressings, instruments, suture material, etc. It is advisable, however, for the nurse to inquire if she is expected to provide any of these articles, particularly in large towns where they are so easily procurable. The nurse should also inquire if the instruments are to be sterilized at the patient's home, in which case a suitable vessel for boiling them and a quantity of bicarbonate of soda should be at hand. In all operations certain solutions will be required and three or four small glass vessels should be in readiness to receive them. These should be sterilized by boiling for twenty minutes or immersion for twenty minutes or more in 1 : 1000 bichlorid in a large vessel or the bath-tub. The large por-

celain vessels and pitchers for irrigating solutions should be similarly sterilized.

In all ear operations the following should be at hand: Alcohol, 95 per cent.; hydrogen peroxid; solution of adrenalin chlorid 1: 1000; normal salt solutions (hot and cold in large quantities for irrigation of wound and possible rectal injection or intravenous infusion).

The same are likely to be needed in any major nose and throat operation. In operations for tonsils and adenoids the nurse should be provided with a dish of sterile water into which the fragments of adenoids may be shaken out. Many surgeons like to have towels in ice-water to be dashed into the patient's face to stop hemorrhage or to hasten recovery from the anesthetic.

In operations upon the eye sterilized solutions of cocain (4 and 8 per cent.); atropin (1 per cent.); adrenalin chlorid (1: 1000); bowls of solutions of boric acid, normal salt, and distilled water are to be provided; also plenty of pledgets of absorbent cotton or gauze wrung out of boric acid solution.

To summarize. The following list of what is mainly needed for an operation in a private house may be appended:

(1) Operating table.

(2) Two smaller tables: one for instruments and one for dressings and solutions.

(3) Stool for anesthetist.

(4) A small table for anesthetist's outfit.

(5) A flat dish of alcohol for knives.

(6) A bowl of sterile water on instrument table for rinsing.

(7) A small pitcher for irrigating solution.

(8) A pus basin or some substitute for catching the irrigating fluid.

(9) Small glasses or bottles for adrenalin, cocain, atropin, hydrogen peroxid, etc.

(10) Several large porcelain or graniteware pitchers for hot and cold normal salt solution.

(11) A foot-tub or large pail on the floor by the operating table for soiled sponges.

After the vessels, except the foot-tub, have been thoroughly sterilized, they should be placed on a sterile table and then filled and covered with sterile covers made of towels or several thicknesses of gauze wrung out in 1:2000 solution of bichlorid of mercury.

(12) Three basins for the hand solutions (alcohol, sterile water, and bichlorid of mercury 1:1000) should be first sterilized and then filled.

(13) 8-ounce bottle of tincture of green soap.

(14) Sterile nail-brushes and nail-picks.

CHAPTER VI

THE NURSE'S DUTIES AT OPERATIONS

THE nurse who assists at the operation must render her hands aseptic and be ready to sponge, hand instruments, thread needles, hold retractors, and apply dressings, as the requirements arise. Hand solutions, sponges, sterile sheets, and towels are to be previously prepared and placed within easy access of the assistant. In nearly all operations upon the nose and throat, except cervical adenitis of the left side, the operator stands at the right of the patient, and within his reach on the same side should be placed the required instruments.

The table for dressings, sponges, astringents, and sterile towels should be on the left side of the patient, accessible to the assistant; while the table for the anesthetist should be at the head of the patient and to his right and supplied with a few large gauze sponges, a few small towels, and a hypodermic syringe loaded with $\frac{1}{100}$ gr. of nitroglycerin and $\frac{1}{60}$ gr. of strychnin, unless otherwise ordered. A nurse is not called upon to note the general condition of the patient, as "facies," respiration, pulse, or the color of the blood unless requested to do so by the doctor; but should the attention of the operator and the anesthetist be diverted by some unusual circumstance, and the nurse apprehends danger from her own observation, it will not be deemed officious should she call their attention to the symptoms noted.

A nurse should never leave an operation to attend the telephone, door bell, anxious member of the family, or any other summons unless permitted to do so by the operator.

After the nurse's hands have been surgically cleansed, any article not sterile should be handled with a sterile towel or piece of gauze, so that the necessity for resterilizing the hands may be obviated.

If the floor has been properly protected by old sheets over newspapers, the necessity for throwing soiled sponges and dressings in a proper receptacle is not so imperative, but when the patient is coming out from under the anesthetic a proper receptacle must be at hand in case of vomiting. A pus basin is the best, but a small bowl or even a soap dish will answer in an emergency. These provisions are a part of the nurse's duties at private houses; in hospitals such provisions are a part of the regular equipment. During an operation the operator is frequently intent upon a certain part of the procedure to the mental exclusion of other parts, and he will frequently want certain instruments, sponges, dressings, or sutures, while unable at the moment to call them by name; if the assistant or nurse recognizes such want and supplies it it is called "anticipating" the want of the operator, and such a quality in a nurse greatly enhances her value at an operation.

Patient's Bed.—The nurse should invariably see that the patient's bed is properly prepared before she gives her attention to the operation; such preparation consists in removing the pillow and placing a folded sheet or bath towel where the head will rest, and if a rubber sheet is convenient it should be placed beneath the

towel to protect the bedclothes. The bed should be warmed by hot-water bottles which should not come in contact with the patient, as frequently bad burns have resulted therefrom. This rule should be followed in summer as well as in winter, for the patient's resistance is always lowered by the anesthetic, and cold, pneumonia, and shock may be often avoided by proper after-care of the patient.

A nurse should never address the operator upon irrelevant subjects while the operation is in progress.

The Nurse's Duties After Operation.—The anesthetist ordinarily returns the patient to the bed, but should he need the nurse to steady either head or foot, it is her duty to render such assistance.

Should the anesthetist remain for a while with the patient, the nurse can remove the floor coverings, sponges, table sheets, etc., and clear away, as much as her time will permit, all evidences of the operation. It is unwise to permit either the family or any of the domestics to remove the bloody evidences of an operation.

The ordinary individual retains an unpleasant memory of the sight of an operating room after the performance, and it is the nurse's duty to lessen this unpleasantness as much as possible. Should the anesthetist have to depart immediately after the operation, as is frequently the case where a special anesthetist is employed, it becomes the duty of the nurse to attend the patient until after the tendency to vomiting is over or until the drowsiness following the anesthesia gives her a few minutes in which to wrap up the soiled linen and sponges.

The next attention of the nurse is the comfort of the patient. If possible, without offending the family, keep

them all out of the room, and if nothing is wanted and the patient is in no danger, send them for a walk or drive. Their presence only complicates the nurse's duties and is of no avail to the patient.

The doctor ordinarily leaves instructions for the care of the patient; should this be omitted, it is not advisable to give any nourishment within two or three hours after the operation. Then a small quantity of pulverized ice may be tried or sips of hot water. Should the operation be for the removal of tonsils and adenoids, the hot water is contraindicated, as it might induce bleeding. Great difficulty is experienced in getting the first liquids to remain on the stomach, and in this condition the good judgment of the nurse plays an important part. Ice-cream for postoperative throat cases is quite acceptable, but some children are never allowed ice-cream when well, and should, therefore, not be permitted to have it under these circumstances. Frequently a little gum-arabic-water with a few drops of lemon-juice in it, or the white of an egg beaten up with a little lemon or sherry wine, will be retained by the stomach. Some operators claim that dry food is far better than liquid in cases of protracted vomiting, and recommend toast, zwieback, and crackers. Not for several hours after an operation should any attempt be made to give the patient food in any quantity, and the character of the food should be determined by the doctor.

In most operations on the nose and throat a certain quantity of blood has been swallowed, which offers the most fertile medium for infection by the numerous bacteria of the intestines, and if not quickly removed results in undesirable intestinal disturbance. In such

cases the administration of a cathartic on the following morning is almost a necessity. In other operations upon the head the necessity for a cathartic is not so imperative, though equally advisable. Should the doctor omit mentioning the character of the cathartic, it is advisable to give such as is ordinarily used by the family, or, if possible, consult with the doctor concerning it. By no means substitute one of your own selection unless requested to do so by the relatives of the patient, and in that case castor oil is by far the safest and least irritating. It may be given in sarsaparilla without the least detection of the oil; 2 ounces for an adult is by no means too much, and greater pain from griping is produced by too little than by too much. After certain operations upon the eye, and especially after cataract operation, it is dangerous to administer a cathartic, and, therefore, the nurse should never give a cathartic after an operation on the eye without an order from the surgeon.

The nurse should always take the temperature, pulse, and respiration of the patient before and shortly after the operation, and record it. If the patient's mouth and tongue become sticky and disagreeable it is her duty to swab out the mouth and clean the tongue and gums with some camphorated solution, such as listerin and water or any mouth-wash the patient may fancy. Too much attention to the comfort of the patient cannot be given, and such attentions determine the acceptableness of the nurse to patient and doctor. Conversation with the patient after operation should be avoided, and when allowed, it is always expedient to let the patient determine the subject of conversation. Interference with the domestic arrangements of the household is to be avoided as much

as possible consistent with giving the patient the necessary attention. Many domestics resent the presence of a nurse, and will frequently attempt to thwart her endeavors in behalf of the patient; such attempts should not influence the nurse in the persuance of what she considers her duty. She should endeavor to disturb as little as possible any of the established routine of the household and not demand too much attendance from the domestics. If the case is one requiring the services of only one nurse, she is entitled to two hours each day for recreation. Sufficient time for sleep must always be considered. Should the case require the care of two nurses for day and night duty, then it is not expected that the nurse will take two hours out of either of these periods for herself.

Sponge-bathing followed by an alcohol rub is an established procedure in all cases, unless otherwise ordered by the doctor.

CHAPTER VII

THE NURSE'S DUTIES IN EMERGENCIES

HEMORRHAGE

THE degree of hemorrhage should determine largely what course the nurse should pursue. In nose and throat cases a certain amount of hemorrhage is expected, and to control moderate hemorrhage certain styptics have been left with the nurse to meet this contingency. Mild hemorrhage from the nose may often be controlled by injecting therein a medicine-dropper full of hydrogen peroxid diluted with one-third water. Iced cloths placed over the nose or slapped on the face, so that a certain shock is produced thereby, exercising a moderate nervous influence upon the vasomotor system, will frequently control the bleeding. Adrenalin solution in full strength run into the nostrils with a small bulb syringe, or a solution of tannic and gallic acid, consisting of 1 dram gallic and 2 drams tannic acid added to 1 ounce of water, also acetotartrate of aluminum (1 part in 8 parts of water), used in the same way, will often overcome the hemorrhage if it is not too severe. Pressure on the bleeding side with the ball of the thumb and continued for ten minutes is often effective. If, however, the flow is continuous and assumes in the mind of the nurse the importance of a real hemorrhage, she had best telephone for the operator, and, failing in this, get some surgeon near at hand.

It would not be advisable for the nurse to attempt packing the nose under ordinary circumstances, as the supply of necessary instruments and packing would not be at hand, but should these be left by the physician and the hemorrhage become alarming, it would be good judgment for her to pack the nose until the doctor arrived, having first wet the gauze in pure adrenalin or alum solution.

This may be accomplished by running a loop of gauze far back into the nostril with the two ends held outside the nose, into which loop is packed other strips of gauze until no more can be introduced. This packing is best accomplished by the use of a cotton applicator wound with only sufficient cotton to protect the point and then wet with water. This moistened tip will engage the gauze and facilitate packing while not endangering the nasal mucous membrane. Pledgets of cotton the size of the little finger wrapped loosely upon the applicator may also be packed in the nostril and left there by disengaging the applicator.

It is well to moisten these pledgets in adrenalin or alum solution before introducing, and also to record the number of pledgets introduced. Hemorrhage following the removal of adenoids is controlled by injecting hydrogen peroxid in full strength through the nostrils and with sufficient force to come against the back wall of the pharynx, from which location the adenoid has been removed.

The same solution of tannic and gallic acid and adrenalin solution may likewise be injected through the nose.

In cases of emergency, when these styptics have not been left for the use of the nurse and time appears an

clement in the consideration of the patient, vinegar, lemon-juice, or alum solution may be employed through the nose in a similar manner.

It is absolutely impracticable for a nurse to apply a postnasal tampon, though she should be able to make one and have it ready at all operations for the removal of adenoids or in operations upon the sinuses. A postnasal tampon is made by rolling a piece of gauze tightly to the size of the thumb, which is tied with a heavy silk thread in the middle, leaving two ends attached about 18 inches long. The ends of he gauze roll are now trimmed off until it is about 1½ inches long.

In the application of the tampon one of the strings is pulled through the nose by means of a Bellocq's canula and the gauze plug pulled into the nasopharynx with the aid of the index-finger of the surgeon. The string that is pulled through the nose is tightly tied to another roll of gauze, which holds it in place at the vestibule of the nostril.

The other string is left extending out of the mouth, to aid in dislodging the plug when it is necessary to remove it. No plug should remain in place over twenty-four hours, owing to the danger of ear infection.

Tonsillar Hemorrhage.—Here frequent sips of tannic and gallic acid solution, in the same proportion previously mentioned, held in the mouth against the bleeding area, is by far the best astringent.

Adrenalin appears to be of little avail when used locally. Hydrogen peroxid held in the mouth or pieces of ice dissolved slowly often prove of value. Any exertion of the pharyngeal muscles, as in the act of gargling, will protract the bleeding by dislodging the clot. The

iron mixtures, as perchlorid and simple chlorid of iron, make a very thick disagreeable clot, and should not be resorted to, except when other astringents are not present or when the others have failed to accomplish their purpose. Cold externally is not of much value. Alum solution, vinegar, and lemon-juice may be employed in emergencies when other means are not available.

If the nurse can determine which tonsil is bleeding, she may be able to press a piece of gauze against that point by means of her thumb within the mouth and the middle finger against the tonsillar area externally, thus converting her hand into an improvised tonsillar hemostat. It is impracticable for a nurse to attempt applying any of the modern tonsillar hemostats in use, as Mikulicz-Stoerk's, Butts', or Hurd's.

Hypodermic injections of adrenalin in 10-minim doses for adults and 5 minims for children, every two hours, frequently prove very effective. Lactate of lime (gr. x) twice a day for several days or until 60 gr. have been given previous to an operation lessens the amount of hemorrhage at the time of operation.

Gelatin held in the mouth against the bleeding area until cooled will often aid in controlling the hemorrhage.

Opium (or any of its alkaloids, as codein, heroin, or morphin) is quieting and, therefore, beneficial in all forms of hemorrhage. The nurse should inspect the pharynx in supposed cases of hemorrhage, as the patient will often swallow the blood until nearly exsanguinated, without attention being called to it. Concealed hemorrhage may be detected by the pulse, which is rapid, thready, and frequently intermittent. If the nurse will notice carefully, she will see that the patient often

swallows or makes a movement of the throat simulating swallowing.

Should the patient vomit blood more than once, even though it is dark colored, attention should be given to the throat, and if the patient continues to vomit or expectorate bright red blood, the doctor should be summoned immediately.

To obviate the swallowing of blood by the patient, the head should be lowered and the face turned on the right side, so that the blood will gravitate through the nose or mouth.

An increasing pallor of the skin, with more or less perspiration on the forehead, is indicative of bleeding.

A clot often forms on the tonsil; extends directly into the esophagus, and drains blood into the stomach until vomiting occurs. Such a clot is not effective in controlling the hemorrhage and should be removed, so that the styptics may come in contact with the bleeding area. If the patient has not recovered from the anesthetic and is bleeding, the head should be lowered, so that the blood will not enter the lungs or the stomach. Hemorrhage is frequently prolonged by the patient sucking the blood away from the wound. This may be prevented by placing a cork between the teeth.

VOMITING

Moderate vomiting is to be expected in cases of general anesthesia, and requires attention only to prevent the inhalation of food products or blood-clots. Should foreign matter be drawn into the larynx, a sharp blow on the back will ordinarily dislodge it by the sudden expulsion of the residual air held in the lungs. Should

this fail, the introduction of the finger into the larynx and pulling out any foreign substance therein is advisable.

Should the choking continue, the patient can be inverted if a child, or the head and shoulders lowered over the side of the bed if an adult, and the back pounded at frequent intervals.

However, if the matter is not dislodged in the first instance, get the nearest physician at hand to attend the patient and telephone for the surgeon who has operated.

Vomiting sometimes becomes persistent, and taxes alike operator and nurse to overcome it. Absolute rest of the stomach for a period of six hours will frequently prove the best course, but the anxiety of relatives to have the patient take "something" will frequently overcome one's better judgment. Champagne or brandy well iced, gum-arabic-water, beaten white of egg, small quantities of dry food, milk and lime-water, large doses of bismuth (gr. xx) every two hours, small doses of wine of ipecac, drop doses of Fowler's solution of arsenic, $\frac{1}{10}$-gr. doses of calomel every half-hour, spraying the throat with ether externally, etc., are all remedies employed for persistent vomiting.

In general surgical cases washing out the stomach before the patient leaves the operating table has lessened postoperative vomiting. It has not been employed to any extent in operations upon the head.

Rise of Temperature

Even in minor surgical cases, a slight rise of temperature just after the operation is to be expected, except in the evacuation of pus, when the temperature ordinarily falls.

A sudden rise of temperature in any operative case, after it has been running a regular course, is sufficient cause for notifying the doctor. Should the temperature fall to subnormal in any operative ear case, notify the operator at once. Either rising or falling temperature, after a period of continuous fever, is an index to the condition of the patient and must be communicated to the doctor.

Should there be a rise of temperature to 104° F., and it is impossible to confer with the physician in charge, an alcohol sponge should be given. Frequently the cause of a rise of temperature, both in simple and complicated cases, is due to intestinal fermentation, and calomel followed by castor oil or a dose of magnesium sulphate will remove the cause and lower the temperature. Some physicians grant permission to the nurse to give cathartics under such circumstances in uncomplicated cases, but it is far more expedient to notify the physician and gain his consent to give any medication.

When gastro-intestinal disturbance is not the cause of the rise of temperature, it is usually due either to toxic absorption from the wound or to invasion of some other area by the infective micro-organism present in the first instance, and only the physician is qualified to deal with the condition. Erysipelas and iodoform-poisoning must also be borne in mind as possible causes.

SHOCK

The possibility of surgical shock should be constantly borne in mind by the nurse, and no condition coming under her supervision calls for quicker action or calmer judgment.

Her recognition of shock is made entirely by the symptoms present, which are pallor, with cold and clammy skin, dilated pupils, reacting slowly to light; irregular, weak, thready, and frequently imperceptible pulse; irregular, sometimes sighing respiration; loss of voluntary muscle movement; occasional nausea or actual vomiting. The temperature is usually subnormal and there is great thirst and restlessness. There may be mental inactivity and loss of control of bowels or bladder, and, lastly, coma.

Do not give strong liquors by mouth at this time, as they are likely to enter the larynx and create irritation, nor strong inhalations of ammonia, etc. As shock is probably due as much to cerebral anemia as to any other cause, lower the patient's head, so that blood may flow thereto, and bandage the lower extremities.

If the face becomes cyanotic, the head should be raised and the bandages removed. Stimulating drinks, if the patient can swallow, should be given diluted with hot water.

External heat should be applied, but carefully, as burns are not infrequent under these circumstances. An enema of hot black coffee with an ounce or two of brandy added is of great value. The doctor should be summoned at once, when he will give strychnin, brandy, digitalis, and other heart tonics in large doses. If the shock is due to loss of blood, saline infusion should be given, or a hot saline enema with brandy, until the doctor arrives.

ERYSIPELAS

Erysipelas is an infection of the skin, and may follow any operation upon the head. It is probably more fre-

quent in mastoid operations than in any of the others of the head.

A dermatitis of a roseate color beginning adjacent to the operative area, accompanied with pain and a rise of temperature, should be the first warning to the nurse. The beginning is frequently associated with gastric disturbance that is inexplicable. Pain in the joints simulating rheumatism is often present.

Immediate attention of the doctor should be called to the condition, as it is frequently a serious complication and may be readily transmitted to other surgical cases.

Should the doctor not be in ready communication with the nurse, it is justifiable for her to put on a 25 per cent. ichthyol in glycerin poultice and give dram doses of the tincture of chlorid of iron in water every three hours until she can consult the physician.

DRUG POISONING

Iodoform.—Some people are peculiarly susceptible to iodoform-poisoning, and even death is known to have resulted in certain surgical cases from dressings of iodoform gauze.

The symptoms are rise of temperature, reaching 104° F. or higher; headache, loss of appetite, rapid pulse, with low tension, even running as high as 180; general depression, restlessness, and sometimes collapse. The treatment consists in withdrawing the dressings and giving small doses of opium, and in the judicious use of stimulants. The nurse should remove the dressings, if the surgeon is not within reach, and substitute plain sterile gauze. The rest of the procedure should be left to the physician. Not infrequently a rash appears upon the

body, and is particularly noticeable adjacent to the wound.

Carbolic Acid.—There exists an idiosyncrasy to this drug in many people, and in these cases even the dressings of carbolized gauze will produce loss of appetite, nausea, feverishness, headache, vertigo, and depression, which may ultimately develop into coma.

The most accurate diagnosis is in the chemic examination of the urine and also by its smell and smoky appearance.

Lime-water, Glauber's salt, and gum-arabic-water should be freely given internally, while alcohol will neutralize the local effects. In cases of attempted suicide by carbolic acid, alcohol given immediately will, in many instances, overcome the effects. Atropin hypodermically is also given.

Bichlorid of Mercury.—If taken internally by mistake or otherwise, the antidotes are white of egg, magnesia, milk, lime-water, and gluten.

Cocain.—Cocainism is manifested by the pulse becoming first quick and forcible; later becoming small, rapid, and intermitting. Respiration is slow and shallow and the patient complains of a tightness about the chest. The skin becomes cold and clammy, and the subject is impressed with the belief that death is impending. The pupils dilate and the mouth becomes dry, the patient complaining of an inability to swallow. Ammonia may be given the patient to inhale, and 1 ounce of whisky in water may be given by mouth.

Opium and chloral are given by mouth, while the inhalation of chloroform or ether will shorten the existence of the symptoms.

CHAPTER VIII

MANAGEMENT OF TROUBLESOME CHILDREN

THE care of children presents some of the most difficult phases of nursing, but it is a very important branch of service, and no training for general work is complete without actual experience in the children's ward, nor can any nurse be regarded as fully qualified for a general practice of her profession who has not proved herself competent in this branch. The possession of an inborn love for children is undoubtedly an invaluable factor and not to be underrated, but, in almost every candidate, compensation for its absence can be secured in a highly practical degree through thorough self-control and the exercise of tact, of quiet, unruffled patience, and of kindly, but not demonstrative sympathy.

The child presents an entirely new problem as compared with the adult patient. The latter's reasoning power is, at least, comparatively well developed, and he is correspondingly governed by his own appreciation of necessity and fitness; but the child, in direct proportion to its youth, is only an uncomprehending subject of the will of those about it. Its own more or less unconscious will is exercised only in resistance to what disturbs or alarms it, and the degree and character of such disturbance and alarm are due, outside of actual physical suffering, to two conditions—its previous training and its present treatment.

Unfortunately, not only is the nurse necessarily ignorant of the previous training, but in the great majority of cases this training is not of a character to induce ready submission to the requirements of proper care, and she is compelled to overcome the child's resistance through either tactfulness or force. The latter should never be resorted to until all reasonable efforts in the former have failed. This course is not only humanitarian, but scientific. The mental condition of every patient is of prime importance, and a child that is violently rebellious, or even morose, grieved or alarmed, is necessarily at a corresponding disadvantage in its physical condition.

The gaining of the patient's confidence, however young the patient may be, must be an ever-present purpose from the outset. This is often no easy task, and first impressions are all important, but, this confidence once gained, the nurse is well started in her work. Not only her every movement, but her manner, attitude, features, voice, touch, should be expressive of promptness without haste, kindly interest, gentleness, and sympathy without indulgence, firmness without harshness, and, above all, of absolute truthfulness. Facts may advantageously be presented in their brightest and most hopeful aspects and without prominence of their unpleasant features, but never contrary to truth; and no promise should ever be made without punctilious performance. A child's faith in its elders assumes infallibility and, this assumption once shattered, confidence and its benign consequences are lost forever. Furthermore, children are imitators, and example is more effective than precept.

The patient's peculiarities should be carefully studied

and availed of in all possible ways for its care and control, and every unnecessary cause for alarm studiously avoided. Unreasoning fear, occasioned by carelessness or thoughtlessness in the performance of some simple duty, will remain inseparably associated with the act in the patient's mind and render future performance of the duty a constant and perhaps serious source of disturbance; or the fear may associate itself with the nurse herself and render her future service or even presence impracticable. Fear of or aversion to strangers or strange surroundings may for a time place the nurse at a disadvantage, but a kind word or a toy at the right moment may distract the attention and dispel the fear. Regularity is essential. Young children especially very soon establish habits, and a child that is cared for regularly will not be sleepless and fretful at night without physical cause.

The nurse who carefully and conscientiously studies the full import of the foregoing suggestions and faithfully applies them, will generally encounter no serious difficulties in the care of children, but occasionally a patient will be found that obstinately refuses to take the medicine or submit to the treatment prescribed. Arguments, entreaties, and promises (that can be fulfilled) may be employed to advantage, but never, under any circumstances, menaces or threats of any kind.

If, notwithstanding all reasonable efforts, the patient still persists in refusal, no further time should be lost in coaxing that will probably have to be repeated day after day or perhaps several times a day. In case of dressing, everything that is to be needed having first been got in readiness, the nurse should promptly wrap a sheet closely

about the child's body, arms, and legs, to prevent struggling and prepare it for the doctor (Fig. 3). In case of refusal to take medicine, the child should be swathed in the same manner and its nostrils held closed till it opens the mouth to breathe, when a spoon with the medicine should be inserted as far as possible, emptied, and withdrawn.

When it is not necessary or convenient to swathe a child, the following methods may be used:

Restraint for an Eye Examination.—The nurse, seated in front of the surgeon, nearly facing him, takes the child on her lap on its back and places its head be-

Fig. 3.—Swathed child, method of restraint.

tween the surgeon's knees. Then with one hand she holds the child's wrists and with the other she supports the child's back or neck or assists the surgeon by drawing down the lower lids (Fig. 4). Usually the surgeon does not need assistance in holding down the lower lids, and the nurse's second hand can be used for supporting the back of the neck or head.

Restraint for an Ear Examination or Dressing.—The child's head is covered with a towel which has been moistened to prevent slipping. For this purpose it is well to use an antiseptic solution. The nurse, seated

before the surgeon, takes the child on her lap and throws one of her legs over the child's legs and at the same time over her own other leg. With one hand she grasps the child's wrists and with the other she keeps the head firmly held against her own chest with the affected ear toward the surgeon (Fig. 5).

Fig. 4.—Method of restraining child in eye examination.

Restraint for a Throat Examination.—The nurse, seated before the surgeon, takes the child between her knees, confining its legs by firmly crossing her own around them; then passing her arms under the child's, she places her hands on its forehead, holding the back of its head against her own chest (Fig. 6).

This may seem harsh treatment, but it should all be done gently, firmly, and deliberately, without haste, excitement, or anger. It will soon be accepted by the

patient as inevitable, and will probably result in gradual decrease of resistance and final submission without further repetition of the procedure being necessary. Should the child struggle so hard that the consequent exhaustion seems liable to counteract the benefit, the physician

Fig. 5.—Method of restraining child for an ear examination or dressing.

Fig. 6.—Method of restraining child for a throat examination.

should be promptly informed of the conditions, so that he may take the responsibility of determining whether or not the procedure shall be continued.

Close observance of the patient for the purpose of promptly noting and reporting all new evidences or

phases of disease is, of course, one of a nurse's chief cares, but especially is this incumbent upon her in children's cases, where the patients are incapable of supplementing her efforts in that direction.

The mother or other friends of the patient may at times be of assistance to the nurse in gaining the confidence and willing control of children who are old enough to understand, but with infants, and generally with older children, the nurse will succeed better in their absence.

CHAPTER IX

THE IDEAL NURSE AND HER CONDUCT IN THE SICK ROOM

THE qualities of the ideal nurse are so diverse as to be found but rarely in one person—the best woman physically, mentally, and morally. She must have health and the power of endurance that comes from a sound body, for there is only too much truth in the common saying that nursing demands all, not part. Many a pupil nurse, at the close of her term of training, enters upon the practice of her profession a skilled nurse certainly, but already, upon the threshold of her career, handicapped by impaired physical condition. Coupled with sound health there must be physical aptitude and a certain degree of manual dexterity. Her touch should be firm but gentle, light but steady. There is no room in the field of trained nursing for the clumsy, the weak, or the nervous.

The ideal nurse must have mental as well as physical power and aptitude. She must have broad intelligence, sound common sense, acute perception, and the ability of correct observation, of just appreciation of the relative importance of what she observes, and of accurate statement. She must be dignified, quiet, neat, tactful, patient, systematic, and capable of unremitting vigilance; firm and unyielding, that the orders given may be

strictly executed, but gentle in manner, that she may accomplish her duty without antagonism; soothing, not irritating by her presence, and winning the confidence of patients and friends. And to be all this, and to do all that the being it implies, a nurse must have manners, which, as Emerson says, "are the happy ways of doing things."

To care for the sick intelligently and to be able properly to utilize this admirable physical and mental equipment, the nurse must be trained, not by lectures only, but by having every phase and detail of the work under close actual observation.

The regularity and strict discipline of hospital training are of great benefit in assisting a nurse to become punctual trustworthy, patient, obedient, and courteous. However irksome rules and restrictions may sometimes appear, they are indispensable to success, or to any degree of order and comfort where many persons are working together; and especially is this true, when, as is so frequently necessarily the case with pupil nurses, many of the workers are quite inexperienced. Hence all nurses who take their profession seriously—and whoever does not so take it has no right in it—should give cheerful obedience to the rules established for their guidance, and should be faithful and punctual in every duty.

Perhaps in no disease will good nursing be brought out more than in typhoid fever. Here, it is not a question of a few days of giving nourishment and treatment regularly, but of many days or weeks of constant and patient care. The nurse's ability to comprehend the doctor's orders and the patient's necessities means everything. If she has trained herself to thoughtful observa-

tion of her patient and to anticipate his needs, it will be of great advantage.

He may be, and probably is, only semiconscious, but she can usually succeed in giving the nourishment that is so important. It may take time and patience, but if she fails in one way, she will try another. If the patient is poorly nourished, every effort must be made to prevent pressure sores. With neglect of twelve or twenty-four hours, the work of days may count for nothing.

Good nursing also demands that the nurse recognize and be ready for emergencies which may occur in either medical or surgical cases. No time must be lost. The proper thing must be done at once, and her readiness and presence of mind must inspire patient, friends, and attendants with confidence. The surgeon frequently judges the nurse's ability by her promptness and foresight in having everything in readiness, and by her capacity to remember his methods and his favorite dressings. It is trying to both patient and doctor, and under some conditions disastrous, to have to wait for what should have been prepared in advance.

In contagious cases the nurse's knowledge must be sufficient to supplement the physician's efforts for preventing spread of the disease. Many of the details are necessarily left to her, and she is responsible for such intelligent execution of the orders given as will make sure that the necessary precautions are taken.

In addition to the direct personal care of the patient, good nursing includes perfect ventilation, which must be accomplished without draughts and, with some diseases, without change of temperature. The air should be pure,

wholesome, and cool—68° to 70° F., unless some special temperature is ordered—and sunlight must not be neglected.

In private as well as hospital work the nurse must be in correct uniform, no rustling skirts, no perfumery, no jewelry; the first duty of the nurse upon going to the house is to find out where everything that is to be needed is kept. Her time belongs to the family employing her, but she has full control of the patient and of the sick room. She should, however, be as little trouble in the household as possible, remembering that the family is under very great expense, and improvising all she can. She must be gentle, not only of hand, but of voice and of foot; must avoid whispering, using a low quiet tone, and in moving about the house, especially in the night time, make no noise, so that neither the patient nor the family may be disturbed.

The patient may be saved many unpleasant experiences by having placed at the foot of the bed a stand, to keep visitors from leaning against it. The nurse must not sit on the edge of the bed; she must avoid defacing furniture with heat or solutions, and must be especially careful in using alcohol, protecting chairs, tables, or other furniture in use. During a dangerous illness the members of the family may feel that this is a matter of no consequence, but afterward it will appear in quite a different light, and many sighs will be caused by needless defacement.

The trained nurse should be able to adapt herself readily to the disposition of the patient and to the various conditions existing in the household. If she is capable and well trained she will at once take charge of

the sick room and of the patient's diet, and will inspire in the minds of the anxious friends and of the attending physician a feeling of relief that no words can express. Nurses are often considered an expensive luxury; not only, however, does their presence bring with it a great relief of responsibility, but the doctor will have to make many less visits if he has a reliable nurse.

As the patient becomes convalescent the duties of the nurse change. The diet is more varied, and more time is required for the dainty dishes or the more nourishing foods, all of which should be prepared and served by the nurse. The patient must not find the convalescent period tedious. Books and magazines are to be read, letters answered, and flowers acknowledged. Indeed, a nurse should be able to fit in anywhere.

An excellent hospital nurse may succeed poorly in private work, for the executive ability that means so much in the hospital counts for little in caring for a single patient.

The duties of the nurse are many, but the friends of the patient have their duties toward the nurse. If good nursing is desired, the nurse must have proper consideration. During the trying nights and days of illness she loses many hours of sleep, many hours of sunshine. Who else works or, if not actively at work, is confined at her post ready for any duty for twenty-four consecutive hours? The care of every case should be so arranged as to allow the nurse a number of hours daily for sleep and recreation. A good motto for patient, friends, and nurse is Charles Reade's "Put Yourself in His Place."

CHAPTER X

THE FEEDING AND CARE OF INFANTS

In the care of infants and young children there is need on the part of the nurse of keener observation and more accurate interpretation of surface conditions, evidencing welfare or distress, than exists in the nursing of adults, who are able to make known their every want or complaint.

This is particularly true because of the vast importance of the nutritive conditions, data for the estimation of which a nurse must supply the physician from observation alone in many instances.

In hospital work it will frequently devolve upon the nurse to furnish the physician with sufficient previous history to enable him to intelligently undertake the care of the child. She should, therefore, know what points are of importance as relating to the nutritive condition and how to elicit these from the mother. Whatever may be the disease which brings the child to the hospital, there can be nothing as important as the proper provision of nourishment for the patient and the correction of digestive disturbances, if they exist. The following points should be inquired into:

Is the child nursing? If so, how often by day and by night? How long is the child at the breast? If the child is not nursing, how long was maternal feeding continued and with what success? The reason for stopping this

form of nourishment may bring to light important points in the mother's condition or the general family history. If the child has never nursed or if for a short time only, the exact diet which he has had from birth should be learned.

Here a list of the foods given is valueless unless accompanied by an exact description of how each has been made up; how long it was continued and what success accompanied the various forms of nourishment used. The present digestive condition should be carefully analyzed, inquiries being made as to:

The Appetite.—Did the child take the breast well or poorly? or, if on the bottle, was it taken well or not? If other food besides milk has been given, how was this taken? In case of breast feeding it should be asked whether the child took the breast well, continued to nurse strongly until satisfied, or whether, on taking the breast, he fretted, stopped, and refused further nursing, thus indicating his failure to obtain any nourishment, or, again, whether he nursed strongly for a short time and, evidently becoming overfilled, regurgitated his food.

The Gastric Condition.—Has the child vomited? If so, at what times with relation to the ingestion of food, whether immediately following nursing or at irregular intervals between feedings? Vomiting immediately following the taking of the breast or bottle would indicate too rapid feeding or too large amounts of food. Vomiting at irregular intervals between feedings would indicate some defect in quality rather than quantity of the food. The vomiting of large amounts forcibly, especially if associated with constipation, should turn

the attention to the possible existence of some obstruction at the outlet of the stomach. The vomiting of sour material shortly after feeding would indicate that the meals were too frequent; that is, that remnants of the previous meal still remained in the stomach at the time of the succeeding feeding.

Intestinal Condition.—The number of stools daily should be ascertained: their color, their consistency, the presence or absence of mucus; whether there be much gas expelled or much colic from its retention. The normal child should have one, two, or three stools daily. The color will vary with the kind of food taken, being golden yellow in the case of good breast-milk, lighter yellow if cows' milk is given, and darker where cereal decoctions are used. Loose green stools indicate an irritation or inflammation of the intestinal tract. They are green because they have been hurried through the body before the normal change from green to yellow has had time to occur. They are loose because their fluid part has not been absorbed by the body. They may be foul because the digestive processes are poor and products of decomposition are present in abnormal amounts. Mucus indicates a congested mucous membrane. It is to be remembered that after the use of castor oil mucus is always present in the stool; that is, the oil's action on the intestinal mucosa is to stimulate its secretion of mucus.

Stools.—The proper description of a stool should embrace the following points:

Size.—A stool is very large, medium, small, or consists in merely a stain upon the napkin.

Consistency.—It may be homogeneous or curdled,

smooth or lumpy, dry, hard and crumbly or loose, thin, and watery.

Color.—This may be a golden yellow, white, light yellow, brown, green, black, or any combination of these.

Odor.—A stool may have the normal odor, may be merely offensive, or have the foulness of decomposition.

Curds.—They may be present or absent, large or small, white or yellow.

Mucus may appear in shreds, masses, or casts.

Frothiness in a stool should always be reported.

Having familiarized herself with the patient's previous condition, the nurse should learn to recognize and intelligently interpret certain surface indications which mark the varying types of children which may come under her care. The child may be large, normal, or small for his age; he may be premature. He is well nourished, thin, or emaciated, or he may present some local acute disease which is lowering his general bodily resistance.

If the child be premature, weak foods and extra precautions against exposure are indicated; if the child is well nourished and has had nothing but breast feeding, the change now to artificial food should remind one that a weaker mixture is necessary than the age and size of the child would otherwise demand. If the baby has been badly started on inadequate breast milk, later supplemented by poor milk mixtures or general table food, the digestive tract will again be unable to take a food calculated to nourish one of his age. The child otherwise normal, who is suffering from an acute illness, also must be given food and mixtures weaker than would otherwise

be provided. The age of a child does not alone determine the strength of food suitable for him, but careful consideration must be given to the above-mentioned factors.

The Normal Child.—In order to appreciate the abnormal, one must possess a certain knowledge of the normal, child. A full-term child weighs at birth from 7 to 7½ pounds. The head is 1 inch larger than the chest. He is 20 inches long. The average gain in weight is 5 to 8 ounces weekly the first three months, less for the second three, and still less for the latter half-year. At three months he should weigh 12½ pounds; at six months, 15½ pounds; at one year, 20 pounds. It is important that the relation of the head and chest during the first two years should be borne in mind. At birth the head and chest are nearly equal. The head is greater in circumference until the second year, from which time on the chest should be the larger. This is significant in two ways: a small head in early life points to some arrest of the brain's development; later, a relatively small chest is an important sign of nutritive disorders, a common example being rickets. At one year the normal child has six teeth; at one and one-half years, twelve teeth; at two years, sixteen teeth. The condition of the fontanel is frequently an aid to the determination of the general physical condition. It should be closed at eighteen months. Delay in its closing points either to retarded bone formation or intracranial pressure. A sunken fontanel accompanies low vitality and malnutrition, while a tense bulging fontanel is almost invariably found with meningitis and is frequently present in febrile conditions. The normal

child should support the head strongly at four months and be able to sit alone at eight months. He usually walks freely at about the fifteenth month. Objects are recognized at about the fifth month. Hearing is well established during the first week. Single words may be said at the end of twelve months, short sentences toward the end of the second year.

INFANT FEEDING

The question of infant feeding is one that cannot well be condensed to meet the limited scope of this volume. The outward signs of good and bad feeding should, however, be quickly recognized upon intelligent observation of the action of the stomach and intestines. There are three classes of food stuffs which enter into the material used in nourishing children, and as there are three classes of foods, so there are three distinct classes of indigestion, each induced by its own particular cause.

The first of these three classes to be considered is the **fats.** These are contained in the cream of milk, are necessary as heat producers, but do not provide directly for the building up of body tissue. They are somewhat laxative and are, more often than the other two types of food, the cause of indigestion. The first evidence of overfeeding with cream or fat is gastric irritability. This shows itself early by the regurgitation of small quantities of food. Later there may be loose, frequent stools, sometimes light colored, other times green, usually offensive, or if the condition has gone on to a marked extent, constipation may result.

The second class of food stuffs is the **carbohydrates,** including starches and sugars. The function of sugar

and starch in nutrition is similar to that of fats, but they are, to a certain extent, tissue builders. If given in too great quantities their action is chiefly to produce intestinal fermentation with foul, acid, slimy stools. Most of the proprietary foods rely upon carbohydrates for their nutritional value.

The third class of food stuffs is represented by the **proteids,** which are commonly spoken of as making up the curd of the milk. These are the source of the material which the body uses in making up its substance. The evidence of indigestion from them is usually intestinal; that is, we get our warning from the condition of the stools, which are frequently loose, green, and containing much mucus. Colic is frequently present.

Breast Feeding.—Much can be done to regulate the composition of the secretion of the human breast. Since the first or so-called "foremilk" is poorer in fats than the latter part or "strippings," the other elements being fairly constant, it is possible to reduce the amount of food given by allowing the child to nurse from both breasts rather than thoroughly emptying one side alone.

The diet of the mother has a direct bearing upon the condition of the milk. It should consist in three regular meals made up of simple nourishing foods, and avoiding pastry, rich desserts, sour fruits, and salads. In general, poor nourishment on the part of the mother means poor milk; too liberal a diet, a milk erratic in its composition or too rich for infant digestion. Regular exercise is very important in sustaining a proper milk secretion. Care should be taken to provide the mother with uninterrupted rest at night, for upon her nervous condition,

more than upon anything else, depends her success as a wet nurse.

The mother's bowels should be regulated and kept open by the use of cooked fruits, massage, exercise, enemata, and, lastly, drugs. If the milk be scanty and poor, partial bottle feeding should be instituted, the mother given a diet rich in meats, cream, and milk. If the milk be scanty but rich, the fluids given the mother should be increased and the child given a bottle after nursing containing a weak formula. If the milk be abundant, but poor, less fluids are needed by the mother and a diet rich in meats and cream. The breast should be emptied of part of its contents before the child nurses, in order that he may have the richer late milk. If the milk be abundant and rich, the mother's diet should be somewhat restricted, exercise insisted upon, and the child given before each nursing a small amount of barley-water, lime-water, or a very weak milk mixture to dilute the milk which he will later get from the breast. If the secretion from the breast varies greatly in quality and quantity, an early loss of the milk may be expected.

For the first two or three days after birth there is little milk secreted, but a laxative fluid (colostrum) is present, whose purpose is to clear out the intestinal tract of the child and prepare it for the reception of its future nourishment by mouth. During these first three days the child should be put to the breast every four hours to stimulate the milk secretion, and should have warm boiled water in dram doses at two-hour intervals. From the third day to the sixth week the nursing should be every two hours, from 6 A. M. to 10 P. M., with two feedings at night. From six weeks to three months, the feeding

intervals should be two and one-half hours. From three to eight months they should be three hours apart. These figures are subject to wide variations, depending upon the size and strength of the baby. As the child develops, the capacity of the stomach increases correspondingly. The aim should be to give such quantities as will fill it at each feeding, and arrange such intervals as will allow its complete emptying before the time for the next meal. The amount that the child gets from the breast is, of course, controlled by the length of time that he is allowed to nurse; the kind of food that he gets is controlled by (*a*) giving him the alternating breasts, (*b*) the "fore" or later milk from each breast at each feeding, (*c*) the modification of the mother's diet, (*d*) lengthening of the feeding intervals, and (*e*) dilution of the milk by giving barley- or lime-water before nursing.

Weaning may be accomplished suddenly or gradually. The latter is preferable if possible. Sudden weaning is necessary in case of illness on the part of the mother or when the baby persistently refuses the bottle so long as any breast feeding is allowed. Gradual weaning may become necessary because of the too great strain on the mother or because of her inability to furnish the proper food. In gradual weaning there should be introduced one or more bottles a day in place of breast feeding, or the breast feeding may be preceded or supplemented by bottle feeding. If weaning is done before the ninth month, the child should be put upon the bottle; if after the ninth month, it is easier to wean directly to the cup. If the child refuses the bottle, it is always best to let hunger do what argument, coaxing, or force will never accomplish. The child should not see the mother at

or near meal time, the bottle or cup should be presented to the child and he should be allowed to take it or refuse it as he wishes. Nothing, however, should be given until the time for his next feeding has arrived. A child will quickly learn from experience that the meal hour is the only time when food is to be had and will accommodate himself to the necessities of life.

Breast feeding should not be continued longer than to the ninth or tenth month. Bottle feeding should cease at the twelfth to the fourteenth month. If delayed later than this the difficulties will greatly increase, as a child who has become inseparably wedded to the bottle will often refuse milk offered in any other way throughout the rest of his childhood. Maternal nursing is to be conserved and protracted to the greatest possible extent. Weaning, however, should be accomplished where necessary, before the mother is worn out and the child undernourished.

Artificial, Substitute, or Bottle Feeding.—There is only one substitute for nature's food; that is, milk; and the milk most available for use is that of the cow.

Milk is rich or poor according to the percentage of its constituent parts. Percentage feeding means artificial nourishment on mixtures prepared to provide certain percentages of fat, carbohydrates, and proteids, which are made to vary according to the needs of the individual to be fed. This is accomplished by the use of the lower or higher levels from the quart bottle or by different mixtures of plain milk and cream.

Fats, sugar, and proteids occur in breast milk in varying proportions or percentages, according to the duration of lactation; that is, the age of the child which it is nourish-

ing; low percentages or weak food, early; high percentages or stronger food, later. The fats are at first usually about 1 per cent. and increase with the age to 3.5 to 4.5 per cent. The sugar varies less; it is at first high, 6 to 7 per cent.; slowly dropping to 4.5 to 6 per cent. The proteids range from 0.3 per cent. in the early days to 3 per cent. in late lactation. In cows' milk the fats are about 4 per cent.; sugars, 4.5 per cent.; proteids, 3.5 per cent.; these percentages varying greatly, not with the age of the milk, as in the case of the human secretion, but according to the breed and care of the cows producing it.

The foregoing figures will represent the percentages of a good mixed or herd milk. Jersey milk gives us a much higher fat, the percentage here being 5 to 6 per cent. This difference of 1 to 3 per cent. between an ordinary herd milk and Jersey seems small, but that it is of great importance to know the kind of milk which is being used is shown by a comparison of a mixed and pure Jersey milks, the latter being about twice as rich as the former. While the difference to the adult would be simply a little more satisfaction in drinking a glass of the latter, the changing of a baby from a mixture made up of one to the same modification of the other would mean a sudden doubling of the total amount of food taken in a day, and would result almost inevitably in a serious digestive upset. One should, then, know something of the source of the milk which is in use in order that it may be modified much or little, according to its percentage of fats and proteids; but more than this, it should be known that this milk has been taken from healthy cows by clean milkers, into sterile pails, and that it has been quickly cooled and kept cool to keep down the bacterial content.

This bacterial content in milk makes one of the greatest differences between it and mother's milk, the latter being a perfectly sterile fluid.

Milk is spoken of as 4, 7, 10, 16 per cent., according to the amount of fat which it contains, and in making up mixtures for percentage feeding use is made of some one of these, according to the desired relation between the fats and proteids. With a quart bottle of average milk it is possible to obtain by using various levels any of the above-mentioned strengths of milk. The top 10 ounces removed from the quart contain 10 per cent. of fat; the fat-content is three times as great as the proteid. The top 16 ounces contain 7 per cent. of fat, the fats here being twice the proteids. In the whole mixture from the bottle, fats and proteids are about equal.

It is not possible to set down fixed formulas for each period of the first twelve months. The following table is intended to serve only as a general guide in making up and increasing the milk mixtures:

	Ingredients.				Resulting Percentages.				
Age.	Milk.	Lime-water.	Milk-sugar.	Barley-water.	Fat.	Carbohydrate.	Proteid.	Amount of feedings.	Intervals of feedings.
1st week .	3 oz., 7%.	1 oz.	1 oz.	16 oz.	1.	6.	.5	1 to 2 oz.	2 hrs.
2d week .	6 oz., 7%	1 oz.	1 oz.	13 oz.	2.	6.	1.	2 to 3 oz.	2 hrs.
1 month .	7 oz., 7%.	1 oz.	1 oz,	12 oz.	2.50	6.	1.25	3 to 4 oz.	2 hrs,
3 months.	8 oz., 7%.	1 oz.	1 oz.	11 oz.	2.80	6.	1.40	5 to 6 oz.	3 hrs.
5 months.	9 oz., 7%.	1 oz.	1 oz.	10 oz.	3.	6.	1.50	6 to 7 oz.	3 hrs.
8 months.	13 oz., 4%.	1 oz.	1 oz.	6 oz.	2.60	6.	2.40	7 to 8 oz.	4 hrs.
9 months.	15 oz , 4%.	1 oz.	1 oz.	4 oz.	3.	6.	2.80	8 to 9 oz.	4 hrs.
12 months.	16 oz., 4%.	1 oz.	1 oz.	3 oz.	3.2	6.	3.	9 to 10 oz.	4 hrs.

If in place of any of the above, skim-milk be used, and the formula be left otherwise the same, mixtures containing very low fat percentages are obtained.

Formulas made from the top third of the quart are seldom advisable. The high fats such as these formulas provide are dangerous, especially in hot weather and to children suffering either from digestive or general diseases.

The formulas which may be made from the top half of a quart bottle of milk containing 7 per cent. of fat are applicable to infants under five months. Children older than this do better upon milk mixtures made from plain or mixed milk. It is to be remembered that the object in utilizing these milks of varying composition and in employing formulas representing different modifications is to overcome in part divergences between human and cows' milk, and also to meet the digestive idiosyncrasies of the individual case.

Lime-water, 1 ounce to every 20 ounces of food mixture, or sodium bicarbonate, 1 grain to the ounce, are added to the formulas to provide for the proper alkalinity which is lacking in cows' milk. Sugar, 1 ounce to 20 ounces of total food, is added to raise the carbohydrate content of the cows' milk to the needed point. The appended table indicates the amounts of milk suitable for use at various ages. The amount of the food should be in the early months from 1 ounce during the first week to 4 ounces at the end of the third month. A child of six months should take 5 to 6 ounces at each feeding; at eight months, 7 to 8 ounces; at ten months, 9 to 10 ounces. The intervals of feeding should be two hours during the first six weeks, two and one-half hours from six weeks to three months, three hours from three months to eight months, and four hours to the end of the year.

It is important to remember that every increase in

food should be gradual. The strength should rarely be raised by more than ½ ounce of the milk to every 20 ounces of food, for with each increase of the food the digestion is being called upon to perform new work. It is well to alternate the change in quality with increase in quantity; *i. e.*, change amount one time, strength the next. On the contrary, if for any reason it becomes necessary to decrease the food, it must, to be effective, be done abruptly and largely—at least by one-half.

Our interest in the carbohydrate element in the child's formula is chiefly centered in the use of cereal waters and jellies as diluents. They interfere with the formation of the tough food masses in the digestive tract. They aid in the digestion of casein and add to the nutritional value of the food. In the preparation of these cereals we may make use of the grains or prepared flours (preferably the latter), of barley, oatmeal, rice, arrowroot, and granum. If the grain is used it should be cooked three hours; if the prepared flours, forty minutes will suffice. Three rounded tablespoonfuls of the grain to a quart of water, boiled down to a pint, is the proper proportion for obtaining a thick gruel. One rounded tablespoonful of the prepared flour gives the same result. For thin cereal waters suitable for early use, one-half the quantity of grain or flour is used. Barley-water is slightly astringent, oatmeal-water neutral in its action, and the malted food preparations are laxative. The digestion of these cereal waters is facilitated by dextrinizing them. One teaspoonful of a dextrinizing agent, such as "Cereo," added to a pint of the gruel, warmed, and stirred for fifteen minutes, changes the starches into easily soluble sugars and thins the preparation.

There are three procedures by which milk may be further prepared for the child's use: two aiming at safeguarding the child from possible infection from contaminated milk, and one accomplishing a predigestion of the proteid of the milk.

Sterilization by boiling kills more or less completely, according to the duration, all bacteria in the milk. This removes the danger of infection by these bacteria so commonly carried in milk, chief among which are those of typhoid, scarlet fever, and tuberculosis. The process has, however, the objection that in addition to killing off harmful bacteria, it destroys also the lactic acid bacteria which are normally present in milk, and as a result of this, in part at least, the milk so treated becomes constipating and liable to produce scurvy if continued too long. Boiling of the milk is indicated, then, in diarrhea, but as a temporary measure only.

Pasteurization, or the raising of milk to a temperature of 155° F., and maintaining it there for thirty minutes by means of a special apparatus, then quickly cooling, provides us with a method of ridding the milk of most of its bacteria without affecting its digestibility, taste, or fitness as a food. This method is to be employed in hot weather when bacterial growth is most rapid or in cases where the cleanliness of the source of the milk is questionable.

Peptonization, the predigestion of the curd of the milk, is of great assistance in treating weak digestions. It may be partial or complete, according to the length of time that the process is allowed to continue. Fairchild's peptonizing tubes, containing a powdered preparation of the digestive agent found in the pancreatic

gland of hogs, or the same in tablet form, may be used.

For complete peptonization the day's supply of milk, after the addition of the powder, is raised to 100° F. and held there for two hours, at which time all the proteid has been changed over to the most digestible form. The objection to complete peptonization lies in the bitter taste given the milk, on account of which it is often refused by the child. This is of less importance in young children, who will usually soon accustom themselves to the bitterness, but older children, whose taste sense is further developed, are apt to refuse the milk.

Partial peptonization, carried on for fifteen minutes, causes no change in the taste of the milk. At the end of the time desired the action of the powder may be stopped by either bringing the milk to the boiling-point or quickly chilling it. The former destroys the peptonizing agent, the latter inhibits it only so long as the milk is cold. The best method of partial peptonization is as follows: Ten or fifteen minutes before feeding time one-fourth of a tube of the powder is rubbed up in a little water and added to the bottle. This is then kept at 110° F. for the required time and the milk at once fed. In this way the digestion of the proteid continues after ingestion and aids the intestine in its work. Peptonization must not be continued for too long a time. The degree should be gradually reduced in order that the digestion shall not become accustomed to prolonged assistance in its function, and thereby suffer a reduction in its own powers.

During the second year the child is ready for the digestion of beef juice, eggs, scraped beef, and broth made

from mutton, beef, or chicken, and thickened with gruel. Beef juice is prepared by lightly broiling a piece of steak, cutting it up, and squeezing out the juice. This should not be overheated before feeding because of its liability to coagulate if warmed too much. The eggs should be soft boiled or poached, never fried. Orange juice may be given from the seventh month, always at least one hour before feeding. At fifteen months cereals may be introduced into the diet, given with salt and milk rather than with sugar. These should be strained up to the end of the second year. Shad or bass and the pulp of cooked fruits may be given during the third year. There may now be added white potatoes, rice, asparagus, string beans, peas, and spinach. Sweet potatoes, onions, beets, carrots, and squash are to be withheld until the fourth or fifth year.

Regularity in the hours of feeding is of importance during these early years. No food of any sort should be allowed between meals.

SLEEP

The normal child should sleep about nine-tenths of the time up to two months, and two-thirds of the time up to the sixth month. Perhaps the first thing to crystallize in the infant consciousness is the knowledge that to cry brings change, change from hunger to satiety, from the crib to the arms, from the uninteresting quiet of a room alone to all sorts of diversions, as walking, rocking, singing, etc. Every baby should cry some—it is nature's form of exercise during the early months—but an hour daily is sufficient for this purpose, and the habit of turning night into day because of some slight

discomfort on the part of the child will never become established if the baby is made comfortable and dry and put to bed at the proper time for sleep and then left alone to finish out, without taking up, any little crying spells he may elect to indulge in. It is, of course, true that every child at first cries for some definite reason, such as pins, wet napkins, or lumpy uncomfortable clothing—these eliminated, however, the baby should be allowed to cry it out without interruption.

Much trouble and many napkins can be saved by the early training of the bowel. A child of one month may be trained to empty the bowel at a regular time each day if he is held over a chamber and the thermometer or soap stick used to stimulate the rectum to contraction shortly after one of the early feedings.

Temperature

Children's temperatures present some peculiarities. They should invariably be rectal. Mouth temperatures are impracticable and surface unreliable. The heat centers in the baby are easily affected by any internal or external influence and, therefore, the baby's temperature has a wider normal range than that of the adult, and fluctuates to a greater extent in all abnormal states; 98° to 100° F. by rectum is well within the normal limits.

Convulsions

The immediate care of a case in convulsions is a matter of utmost importance, as what is to be done in this instance must, to be effective, be applied at once. The great majority of convulsions are due to intestinal disturbances, usually to the presence of undigested food in

the stomach or intestine. A single convulsion or those occurring at great intervals are usually of less serious import than is commonly believed, and frequently have no more significance than a rigor in the adult. The important point to remember is that whatever is done for the patient must disturb him as little as possible. For this reason placing the feet in a hot mustard foot-bath and wrapping the body in a sheet wrung out from the mustard water, is usually preferable to the general bath, as it obviates the necessity of taking the child from the bed. Ice should be kept at the head and the bowel irrigated with 1 or 2 quarts of hot saline. Chloroform is the best means of quickly controlling the convulsion. Morphin, hypodermically, and chloral, by rectum, should be relied on to ward off continuance of the attacks.

Fresh Air

A proper amount of fresh air is of even more importance to the child than to the adult. A tendency to colds in the head is much more often due to too little air than to exposure. It is the child who is too carefully guarded from all changes of temperature and kept most of the time either in a room which is too warm, or too warmly dressed when out of doors, that is the victim of croup and frequent colds. The room temperature should be between 60° and 68° F. by day and may run down to 50° F. or lower at night.

The Bath

The baby should be given a tub-bath at 100° F. on the tenth day, or if the cord is slow in coming off, after the stump is completely healed. The mouth should be

cleansed daily with cotton and boric acid. In cases with very tender skins soap should be used only once weekly, and if necessary the bran bath may take the place of plain water.

INFANT'S DISEASES

Croup.—Interference with breathing due to spasm or swelling of the throat and bronchial tubes is more alarming in appearance than dangerous to life. A croup kettle should be started under a sheet placed over the head of the crib and mustard plasters applied to the upper chest and throat.

Measles.—This disease is recognized by the signs of a head cold followed by a profuse coarse rash appearing first on face and neck. It is very contagious, but less infectious, and should be quarantined for eighteen days. The onset occurs from eleven to fifteen days after exposure.

Scarlet Fever.—The acute onset, with sore throat and general body blush, most marked in axilla and groin, are the prominent symptoms. It is both contagious and infectious. The patient is dangerous until desquamation has entirely stopped. Symptoms of scarlet fever may appear a few hours after exposure or be delayed up to seven days.

The importance of using great care in all cases of bronchitis in children should be borne in mind, not because bronchitis of itself is so grave a disease, but because of the ease with which bronchial inflammation becomes pulmonary in these young subjects. Therefore treat a cough as a serious matter at least until its source has been definitely ascertained.

One disease every nurse should keep in mind, especially when for any reason the child is on boiled milk or in a condition of malnutrition, is scurvy. The baby who when left alone is quiet, but cries out at once on being handled, and especially when the legs are touched, who has swollen, boggy, dark red gums about the incisor teeth, or swellings along the shins, is frequently made to suffer great and unnecessary torture from failure to recognize the trouble and allow for the accompanying exquisite tenderness, or from the inexcusable rubbing of the legs because they appear sore.

Rickets, which almost any one now recognizes, can be summed up in the one word "susceptibility." If in charge of a rachitic child, a nurse has a piece of Dresden china on her hands which will crack on the slightest blow, and it is to be guarded most carefully from all exposure.

II. THE EYE

CHAPTER XI

THE ANATOMY AND PHYSIOLOGY OF THE EYE

The Orbit.—The eyeball is situated in a bony cavity, called the orbit, which renders the eye comparatively safe from external injuries. The walls of the orbit are formed of several of the bones of the cranium and face and the shape is roughly that of a hollow cone with the base outward. The walls of each orbit are formed of seven bones—frontal, sphenoid, ethmoid, superior maxillary, malar, lacrimal, and palate. Three of these—the frontal, ethmoid, and sphenoid—lie between the two orbits and form a part of each, so that altogether there are eleven bones employed in forming the two orbits. The upper edge of the orbit is called the supra-orbital ridge, and the lower and outer edge is formed by the malar (cheek) bone. Generally the eye is placed so deep in the orbit that a rule resting above on the supra-

Fig. 7.—Front view of orbit showing the optic foramen: *A*, lacrimal bone; *B*, ethmoid bone; *C*, body and lesser wing of sphenoid bone; *D*, greater wing of sphenoid bone; *E*, nasal bone; *F*, supra-orbital foramen or notch; *G*, infra-orbital foramen.

orbital ridge and below on the malar bone will not touch the eye. The nasal bones, which do not form a part of the orbit, but project between them, form an additional protection from injuries by blows.

At the inner end or apex of each orbit is a short circular canal called the "optic foramen," through which

Fig. 8.—Side view of orbit, with eyeball in position. Bones of skull and outer side of orbit are cut away so that shape of orbit may be seen (Campbell).

pass the optic nerve and the ophthalmic artery. The eyeball rests in a cushion of fat called "orbital fat."

The **eyelids** are two movable curtains or folds which, when closed, cover the front of the orbit and shield the eye from injury. The upper lid is larger and moves freely, while the lower lid has only a slight degree of motion. The lids are covered on the outside

with skin and on the inside are lined with mucous membrane called the conjunctiva. In each lid there is a thin plate of dense fibrous tissue which serves to strengthen the lid and maintain its form. From their resemblance to cartilage these plates are called "tarsal cartilages," although the microscope shows that they do not contain cartilage cells. The conjunctiva is very sensitive, and if a foreign body lodges upon the membrane it causes a flow of tears and winking of the lids for the purpose of dislodging the foreign body.

Fig. 9.—Eyelids naturally opened. From a photograph (Merkel). Horizontal plane passes through inner canthus.

The lashes, which grow at the margin of the lids, serve to protect the eye from injury, as the slightest touch of any object on the lashes causes an involuntary winking which often prevents the entrance of a foreign body.

Just inside the line of the lashes are the openings of a row of glands called the Meibomian glands. These glands secrete an oily fluid which tends to prevent the overflow of the tears.

The Lacrimal Apparatus.—Just within the orbit at the upper and outer side is the lacrimal gland, which secretes the tears. The tears keep the surface of the

eye moist. Without such provision the surface of the cornea would become dry and lose its transparency.

At the edge of each lid near the inner angle may be seen a small point called the lacrimal point (punctum lacrimale). From these points, one on the upper and one on the lower lid, lead small canals called the lacrimal

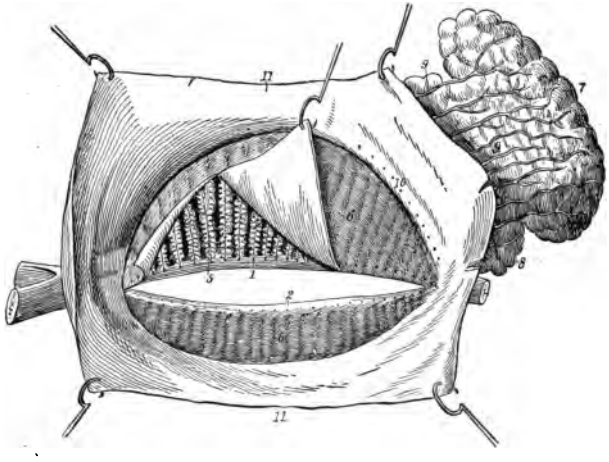


Fig. 10.—Lacrimal and Meibomian glands, the latter viewed from the posterior surface of the eyelids (the conjunctiva of the upper lid has been partially dissected off, and is raised so as to show the Meibomian glands beneath): 1, Free border of upper, and 2, free border of lower, lid, with openings of the Meibomian glands; 5, Meibomian glands exposed, and 6, as seen through conjunctiva; 7, 8, lacrimal gland; 9, its excretory ducts, with 10, their openings in the conjunctival cul-de-sac; 11, conjunctiva (Testut).

canals, which unite in the nasal duct, and this, in turn, opens into the nose.

The tears which are secreted by the lacrimal gland and also by certain cells of the conjunctiva, called "goblet cells," are spread over the eye by the movement of the lids and the eye, and the excess is conveyed through the

lacrimal points into the lacrimal canals and thence into the nose. Under ordinary conditions there is no overflow of the tears upon the cheek, but the tears overflow

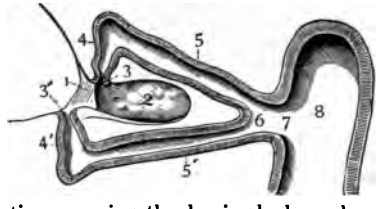


Fig. 11.—Section exposing the lacrimal channels and part of the lacrimal sac (Testut): 1, Plica semilunaris; 2, lacrimal caruncle; 3, 3′, lacrimal puncta; 4, 4′, vertical portions of lacrimal canaliculi; 5, 5′, horizontal portions; 6, fused portion; 7, opening into lacrimal sac (8).

when there is either an excessive secretion or when there is an obstruction to the passage of tears into the nose.

As the lacrimal gland is at the outer side of the eye, while the lacrimal canals are at the inner side, the tears

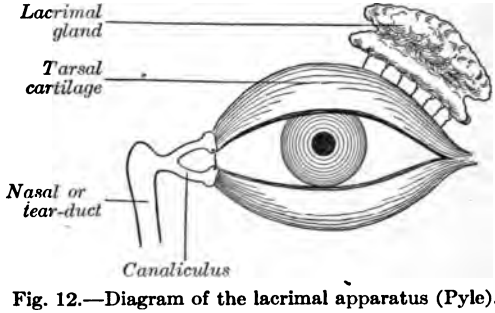


Fig. 12.—Diagram of the lacrimal apparatus (Pyle).

pass completely across the eye, and not only keep the surface moist, but wash away particles of dust which may have lodged in the eye.

The **eyeball** is very nearly spheric in shape and approx-

imately 1 inch in diameter. The outer wall of the eyeball is called the sclerotic coat. The sclerotic coat covers all except the anterior portion, where it is replaced by the cornea. The diameter of the cornea is equal to about one-sixth of the circumference of the eyeball.

Sclerotic Coat.—The name "sclerotic" is from a Greek word which means "hard." It is composed of opaque whitish fibrous tissue, and by its firmness and

Fig. 13.—Lacrimal apparatus (Campbell).

elasticity preserves the form of the eyeball. It is not, however, sufficiently strong to maintain the shape if the contents are removed. Anteriorly it is continuous with the cornea and posteriorly with the sheath of the optic nerve.

The Choroid Coat.—Spreading over the inner surface of the sclerotic coat is a membrane called the "choroid coat," consisting of a network of blood-vessels and nerves with some pigment-cells.

The Retina.—Inside of the choroid coat is the retina. The microscope shows nine distinct layers in the retina, which are bound together by connective tissue containing blood-vessels. Seven of these layers consist of nerve elements. For our purpose it is sufficient to say that the retina consists of two layers. These are: the pig-

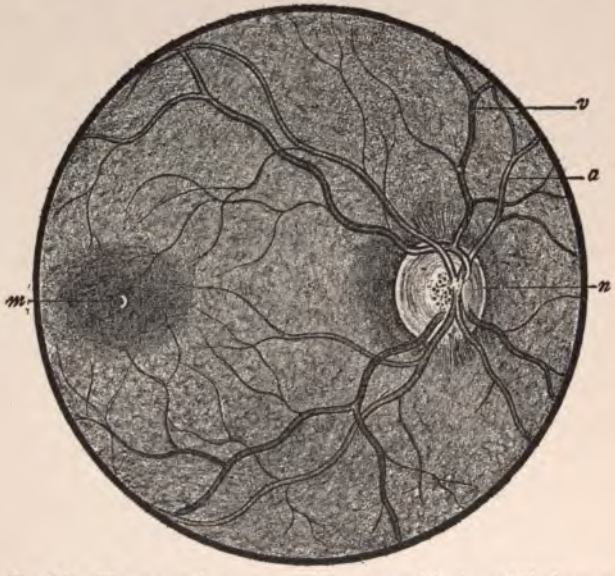


Fig. 14.—The normal eye-ground as seen with the ophthalmoscope, showing the principal blood-vessels of the retina: *n*, Optic nerve-head; *m*, macula; *a*, retinal artery; *v*, retinal vein (Pyle).

mentary layer, which lies next to the choroid coat, and inside of this the nervous layer, which is sensitive to light and receives the images of external objects. The most sensitive part of the retina is the center of the retinal surface in the anteroposterior axis of the eye, and 2 to 3 mm. outside the point of entrance of the optic

nerve. The sensitive spot is called the yellow spot (macula lutea), and at the center of the yellow spot is a depression called the fovea centralis, at which point the acuteness of vision is greatest. The word macula means a spot or stain, and the word fovea means a pit or depression.

The Lens and Vitreous Body.—The interior of the eyeball is divided into two portions by the crystalline lens and its suspensory ligament. All the space behind

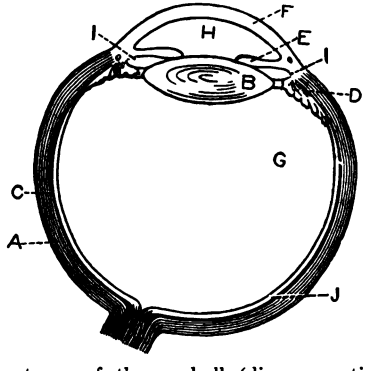


Fig. 15.—Structures of the eyeball (diagrammatic): *A*, Sclerotic coat; *B*, lens; *C*, choroid; *D*, ciliary body; *E*, iris; *F*, cornea; *G*, vitreous body; *H*, anterior chamber; *I*, *I*, posterior chamber; *J*, retina (Campbell).

the lens is filled by a clear colorless albuminous fluid of jelly-like consistency. The vitreous body is inclosed in a membrane called the hyaloid membrane. Opposite the lens this membrane divides into two layers, one of which passes behind the lens and the other in front of it, forming what is called the suspensory ligament of the lens. The word "vitreous" is from a Latin word meaning "glass," and the word "hyaloid" is from a Greek word also meaning "glass" or "glass-like."

These names were given on account of the transparency of the media.

The crystalline lens has the form of a double convex lens and measures about 7 mm. in diameter and about 4 mm. from front to back. Surrounding the lens is a muscle called the ciliary muscle which, by its contraction and relaxation, alters the form of the lens, making it more or less convex, and in this way adjusts the focus for objects either distant or near. As age advances the lens becomes harder and the form is less easily altered by the action of the muscle, and then it is necessary to use glasses to shorten the focus for near objects. This condition of the eyes is called "presbyopia" or "old-sight." In most cases it is necessary to begin the use of glasses at the age of about forty-five years and the strength of the glasses must be increased with advancing years. This rule applies only to those who have normal eyes. On account of various departures from the normal condition it is often necessary to use glasses at a much earlier age and sometimes even in childhood. On the other hand, one who is myopic (near-sighted), may be able to read without glasses long after the age of forty-five years.

The **iris** is a curtain of fibroconnective tissue with two sets of muscular fibers, circular and radiating. This curtain is suspended between the cornea and the lens. There is a circular opening in the center called the pupil. The size of the pupil is regulated by the alternate contraction of the two sets of muscular fibers, and by this means the amount of light entering the eye is regulated. The back of the iris is covered with a layer of black pigment. This layer is continuous with the pigment

layer of the retina, the effect of the whole being to shut out all light except what comes through the pupil. On the same principle the interior of photographic cameras, telescopes, opera-glasses, and other optical instruments is blackened. The color of the iris, varying in different individuals from light blue or gray to black, depends upon the density of the fibroconnective tissue of the iris and the amount of pigment. In albinoes the pigment layer is absent.

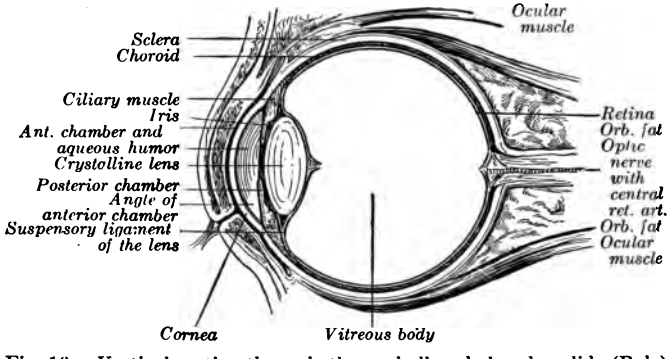


Fig. 16.—Vertical section through the eyeball and closed eyelids (Pyle).

The space between the cornea and iris is called the anterior chamber, and that between the iris and the lens is called the posterior chamber. Both anterior and posterior chambers are filled with a clear colorless watery saline fluid containing proteid substances in solution. This fluid is called the aqueous humor.

The front of the eyeball, including the cornea and the sclerotic coat, to a distance of 6 or 8 mm. back of the cornea, is covered with a mucous membrane which is continuous with that which covers the inside of the eyelids. The portion, however, which covers the cornea

is much thinner, and only the anterior layer of cells is present.

The cornea, aqueous humor, lens, and vitreous body are known as the refractive media of the eye. Rays of light from any object entering the eye are brought to a focus as they pass through these refractive media and form an image on the retina, just as the rays which enter

Fig. 17.—Optic nerve: *A*, Note the two points of constriction (Campbell).

a photographic camera form a picture on the ground glass at the back. The nerve terminals in the retina are sensitive to the various colors and forms, and the picture thus formed is conveyed by the optic nerve to the brain. An image is formed upon the retina of each eye, and the two images are fused in the brain so that only a single object is perceived.

The **optic nerve** is not a single nerve, but consists of many nerves which have their terminals in all parts of the retina, and are gathered into a bundle, forming what is known as the optic nerve. One portion of the retina may be injured, as happens sometimes in case of a hemorrhage, and other portions may still receive the images. In a disease like glaucoma some of the fibers of the optic nerve may be diseased, while others remain healthy. The optic nerve from each

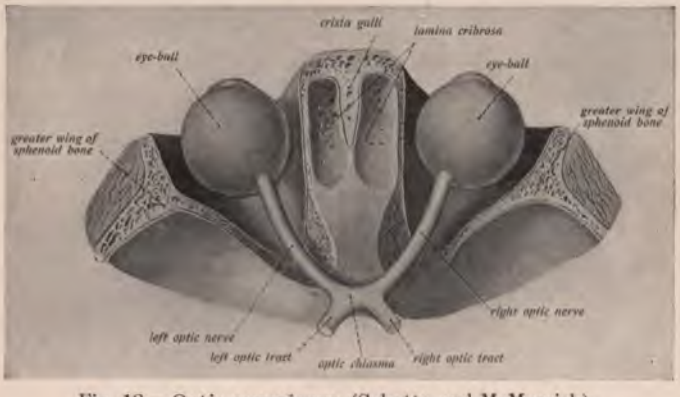


Fig. 18.—Optic commissure (Sobotta and McMurrich).

eye passes backward through an opening, the optic foramen, near the apex of the orbit, and the two nerves coming together a short distance back of the orbits form what is called the optic commissure.

Muscles.—Each eyeball is moved by six muscles: internal rectus, external rectus, superior rectus, inferior rectus, superior oblique, and inferior oblique. It will be noticed that in a state of health the eyes always move together. If an object is placed to the left, both eyes turn to the left in order to see it. If the object is placed

high, both eyes turn upward. If the object is brought near the eyes, the eyes will converge. This is in order that the image in each eye may fall upon the corresponding spots in each retina. If this does not happen there will be double vision. In certain diseases and in alcoholic or other poisoning some of the muscles are paralyzed or weakened, so that they lose the power of

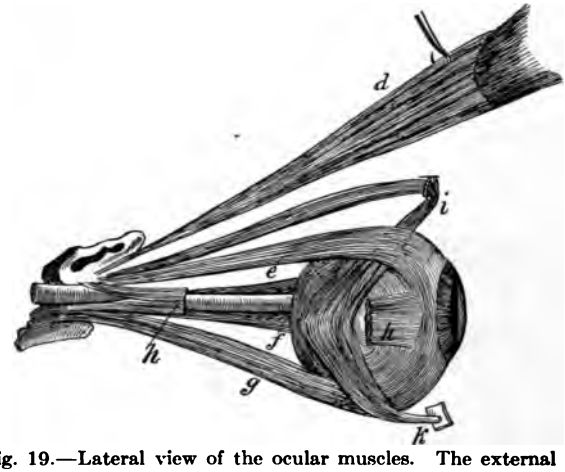


Fig. 19.—Lateral view of the ocular muscles. The external rectus (*h*) is divided, so as to show the attachments of the oblique muscles (*i*, *k*) to the eyeball. The attachments of the four recti muscles (*e*, *f*, *g*, *h*), the superior oblique (*i*), and the levator palpebræ (*d*) at the apex of the orbit are also shown. The superior and inferior oblique muscles pass through loops or pulleys and so the direction of the force applied is changed (Nunneley).

co-ordination, and in such cases there is double vision. By pushing one of the eyes to one side with the finger it is possible to produce diplopia or double vision. Those who are cross-eyed generally have defective vision in the eye which is turned in, but if the vision of both eyes is good, the image in one eye has to be suppressed in order to avoid double vision.

CHAPTER XII

COMMON REMEDIES USED IN THE TREATMENT OF THE EYE

THE remedies used in the treatment of the eye are generally classified according to their action, and such a classification is of service, but it is impossible to make a classification which shall be exact, because many of the remedies may be used in solutions of different strengths and so may act in several different ways. For example, carbolic acid in very weak solution is an antiseptic; in a little stronger solution, while it is still an antiseptic, that is, capable of destroying germs, it is irritating to the eyes or even to the skin and, hence, in this strength it would be called an irritant. If the strength is increased still more it may become a local anesthetic. The hands soon become numb if kept wet with the solution. A still further increase in the strength makes the solution a caustic, as it is then capable of destroying tissue. Instead of ceasing to be antiseptic, it is more actively antiseptic as the strength is increased. Moreover, on different tissues or different individuals it may act differently.

Carbolic acid of a given strength may be irritant to the conjunctiva, but not to the skin. Another solution may act as caustic to the conjunctiva or as an anesthetic or irritant when applied to the skin. In the same way, tincture of iodin is an antiseptic, but it is also a counter-irritant or it may be a local stimulant. Silver nitrate

in very weak solution is an antiseptic and astringent. A stronger solution in the eye is an irritant and a still stronger solution is a caustic. In reading the following classifications, therefore, it will be noticed that some remedies appear under more than one head. Moreover, certain remedies are classified under one group by one writer, which are placed in another group by another writer. This is because the remedies act in more than one way, and one writer considers one property the most important and another writer may think that some other action predominates.

ANTISEPTICS

Antiseptics are used in the treatment of the eye in diseases due to the presence of germs or to prevent infection after operations. They are also used in some cases for sterilizing instruments, bandages, and dressings; as cleansing solutions, and in preparing rooms for operation or in the care of patients after operation.

Boric Acid (also called **Boracic Acid**).—This is used in saturated solution, by which is meant as strong a solution as can be made. A pint of cold water will dissolve only 320 gr. or two-thirds of an ounce of boric acid. A large amount may be dissolved in hot water, but when the water cools the excess will fall to the bottom or be "precipitated," as it is called. This saturated solution may be used as freely as necessary in the eye, since it is not at all irritating, as many of the stronger antiseptics are.

Boric acid ointment in the strength of 10 per cent. is a valuable ointment for the eye, non-irritating and mildly antiseptic.

Borax (Sodium Biborate).—This, also, is only mildly antiseptic. It differs from boric acid in being somewhat alkaline. It may be used in about the same strength as boric acid.

Carbolic acid or **phenol,** which is so valuable as an antiseptic for some purposes, has a very limited use in the eye. It can be used only in very weak solution, about ½ of 1 per cent., but great care must be used, because a solution which is strong enough to be of any value as an antiseptic is likely to be irritating to the eye. A solution of the strength of 5 per cent. is sometimes used for disinfecting instruments, but there is danger of corroding the instruments if exposed too long to the action of the carbolic acid solution. Also sharp instruments are soon dulled.

Mercury.—Several preparations of mercury are used as antiseptics. Bichlorid of mercury or corrosive sublimate is used more than any other preparation. This can be used only in dilute solution. A solution containing only 1 part of corrosive sublimate in 2000 parts of water is quite irritating and causes great congestion of the eye with a severe burning sensation. The usual strength of the solution for cleansing the eye is 1:5000 or sometimes even as dilute as 1:10,000. A solution of 1:500 is sometimes applied to the conjunctiva of the lids after trachoma operations or in chronic conjunctivitis. In this strength it is somewhat caustic. Corrosive sublimate has the disadvantage that it sometimes produces opacity of the cornea, especially when it is used in operations on the eye after an incision of the cornea has been made. It must, therefore, be used in the eye with great caution. In some cases it is irrita-

ting to the skin and, therefore, cannot safely be used for sterilizing dressings to be used on the eye.

Bichlorid of mercury ointment (1 part in 5000 parts of vaselin) is sometimes used on the lids after trachoma operations and after removal of the eyeball, and in those cases where it is desirable to continue the antiseptic action for some time. Biniodid of mercury can be used in about the same strength as the bichlorid. Panas's solution of biniodid of mercury (biniodid of mercury, 1 part; alcohol, 4 parts; water, 20,000 parts) has been used, but the value of so weak a solution has been doubted.

Oxycyanid of mercury may be used in about the same strength as the bichlorid, and has the advantage of being less irritating to the eyes. It may also be used to sterilize instruments, as it does not corrode them.

Iodin and Preparations of Iodin.—Iodin may be used as an antiseptic in corneal ulcers, and is very useful as an application after operations on the lid, as, for example, the incision of a stye. When applied in this way iodin does more than destroy the germs. It acts as a caustic and destroys the dead and diseased tissue and at the same time stimulates the healing process.

Iodoform is in the form of "small lemon-yellow lustrous crystals of the hexagonal system and having a saffron-like and almost insupportable odor" (United States Dispensatory). It is produced by the action of iodin on a mixture of alcohol and solution of carbonate of potassium. Iodoform is sometimes dusted over corneal ulcers. It is also used as an ointment in the strength of 5 to 10 per cent. of iodoform in vaselin.

There are several substitutes for iodoform which are without its disagreeable odor.

Argyrol.—This is a combination of silver with albumin. It is free from the irritating character of nitrate of silver. It is only mildly antiseptic, but experience has shown that purulent eye cases recover more quickly when this is freely used than when it is omitted. This is probably for the reason that a mild antiseptic is more effective when used constantly than a stronger antiseptic which can be used only at intervals. There are several other similar preparations, such as argentamin, argonin, and protargol, but at present the experience with argyrol appears to be the most satisfactory.

Several other antiseptics are occasionally used in the eye, but they are so rarely used that they need only be mentioned briefly here.

Chlorin-water in very dilute solution is recommended in purulent conjunctivitis in the strength of 3 or 4 drams to 1 pint of water. The mode of action of chlorin upon pus has been described in the chapter on Antiseptics.

Hydrogen peroxid somewhat diluted has been recommended to destroy the pus in cases of purulent ophthalmia. It is sometimes quite irritating to the eye and is very little used.

Permanganate of potash in solution not stronger than 1 per cent. is a very efficient wash in purulent cases, but has the disadvantage of staining linen.

Astringents or Styptics

An astringent has the property of contracting the tissues of the body, especially the softer tissues, as, for

example, the mucous membrane. By contracting the capillary blood-vessels it checks the flow of blood.

Substances which have these properties are also called "styptics." Both words are used either as nouns or as adjectives. Thus, we may say "tannin is an astringent" or "tannin is a styptic," or we may say "tannin has astringent properties" or "styptic properties." Styptic cotton is cotton treated with a solution of perchlorid of iron, and has the property of checking hemorrhage.

Most of the astringents are also antiseptic.

Silver Nitrate.—In a weak solution (1 to 4 per cent.) silver nitrate is astringent in its action. When applied to the conjunctiva in stronger solution the action is more or less caustic, in proportion to the strength of the solution. A solution of 10 gr. to 1 ounce (about 2 per cent.) may be dropped into the eye without any damage unless there is ulceration of the cornea. In case of corneal ulcer silver must be used with great caution for fear that it may cause a white opacity. When applied to the conjunctiva the effect of the application is to coagulate the albumin in the outer layer, and this outer layer separates and comes away with the germs contained in it. If used too long, silver nitrate may discolor the conjunctiva. It must, therefore, be used with caution and should not be prescribed to be used by the patient at home. Silver nitrate blackens the skin. The stain may be removed if not allowed to remain too long by applying tincture of iodin to the spot, which will form diiodid of silver, which, in turn, may be removed by ammonia-water.

Solutions of silver nitrate must not be exposed to

the light, as the silver is soon changed to the black oxid of silver. It should be kept in dark brown or blue bottles.

Alum (*Sulphate of Aluminum and Potassium*).—This is found in the volcanic regions of Southern Italy, ready formed in the earth. It has to be dissolved out and purified and then allowed to crystallize by the evaporation of the water containing it in solution. It is also manufactured from minerals found in the same regions, which contain the constituents of alum, and, therefore, are called alum ores. Alum is now manufactured by the direct combination of its constituents, which may be obtained from different sources.

Alum is a very powerful astringent when applied to the mucous membrane of the eye or elsewhere. It coagulates blood rapidly and is used as a styptic in nosebleed or other bleeding from mucous surfaces. It is frequently applied to the conjunctiva in the form of the solid crystal, which is cut in a convenient form, and for convenience in applying may be set in a handle.

Zinc sulphate and **copper sulphate** in very weak solutions act as astringents. In stronger solutions they are irritants.

Tannin or Tannic Acid.—This is an acid extracted from nutgalls. The nutgalls are vegetable excrescences in the leaves or bark of certain plants, especially oaks. These excrescences are produced by the deposit of an egg of an insect. Galls are generally nearly spheric in shape and of a size varying from the size of a pea to that of a hazelnut. Nutgalls are sometimes called oak-apples. The nutgalls are ground to fine powder and treated with ether, which extracts the tannin. Tannin is

easily dissolved in water or glycerin. It is a powerful astringent when applied to mucous surfaces, such as the conjunctiva, the gums, or the uvula. Tannin coagulates albumin very effectively. In the eye, tannin is generally used in solution in glycerin. This solution is sometimes made as strong as 25 per cent. Generally, however, it is used in the strength of 2 to 10 per cent.

Acetic Acid, Dilute (*Acidum Aceticum Dilutum*).—Three strengths of acetic acid are given in the United States Pharmacopœia. These are the glacial acid or concentrated acetic acid, containing nearly 99 per cent. of pure acetic acid. The commercial acetic acid is considerably weaker, as it contains only 36 per cent. of absolute acetic acid and 64 per cent. of water. The third preparation is the dilute acetic acid, which contains only 6 per cent. of pure acetic acid. It is, therefore, important for the nurse to know which of these three preparations is being dealt with. The glacial acid is caustic and is employed for removing warts. Even the commercial acid is a mild caustic. The dilute acid is hardly stronger than vinegar, which consists essentially of acetic acid and water, and may be substituted for dilute acetic acid in those cases where acetic acid is indicated.

Subacetate of lead, in the solution known as liquor plumbi subacetatis, is astringent, but is used only as an external application. It was formerly much used, largely diluted (1 or 2 per cent.), as an eye-wash, but it was discovered that in case of ulcer or abrasion of the cornea there was danger that the lead would form a white opacity, and so its use has been given up.

Adrenalin and **suprarenalin** are preparations made

from the suprarenal glands of cattle and sheep. They act as astringents without the irritating properties of most of the astringents. The usual preparation is the adrenalin chlorid or the suprarenalin chlorid, and this is put up in solution of the strength of 1:1000. A drop of the preparation dropped into an inflamed eye will cause a blanching of the eye in a minute or two. This blanching is due to the contraction of the small blood-vessels, and the effect lasts for an hour or two and is not often followed by a reaction.

If an eye which is to be operated upon under cocain is inflamed, the cocain will act more effectively if the congestion is first removed by instilling adrenalin or suprarenalin chlorid. The bleeding during an operation may be greatly diminished or wholly avoided by the use of these solutions.

IRRITANTS

The term "irritant," when applied to remedies used in the eye, refers to those which when applied locally to the conjunctiva cause more or less inflammation. The object of such applications is to cause an increased flow of blood, and by this means absorption is increased. When an ulcer becomes indolent, with no tendency to heal, the application of an irritant may at once start the healing process. In the case of granular lids the repeated application of irritants may cause the granulation to be absorbed gradually. The term irritant is also applied to certain drugs taken internally, as an "irritant poison."

Following are some of the irritants used in the eye:

Yellow Oxid of Mercury Ointment.—The official ointment contains 10 per cent. of the yellow oxid. In the

eye, however, it cannot be used in this strength. The strength for the eye varies from 1 to 3 per cent. The yellow oxid of mercury is a very fine powder, and shows no crystalline particles even when examined under the microscope. The yellow oxid of mercury differs from the red oxid in being in a much finer state of division. The yellow oxid has nearly displaced the red oxid in eye treatment, because the red oxid frequently causes more irritation than can be borne. This is perhaps due to the fact that no matter how finely the red oxid is divided it still shows crystalline particles. The yellow oxid of mercury ointment is used in cases of ulcer of the cornea and in blepharitis marginalis (inflammation of the eyelids).

Calomel or mild chlorid of mercury is also used as an irritant to stimulate the healing of ulcers of the cornea.

Sulphate of Copper or "Bluestone."—This occurs in nature in the water which flows through copper mines. When this water is evaporated the sulphate of copper is deposited in the form of crystals. It may also be obtained by heating together copper and sulphuric acid. The product obtained by heating these together is dissolved in hot water and the crystals of sulphate of copper form when the water is evaporated and cooled. For use in the eye the crystals are cut to a convenient form and mounted generally on wooden handles. In cases of trachoma or granulated lids the crystals of bluestone are applied directly to the conjunctiva. This application is exceedingly irritating, but results in the gradual disappearance of the granulations. The granulations are not burned away, as some suppose, but the irritation of the bluestone causes a gradual absorption.

Sulphate of zinc acts similarly to sulphate of copper, but is less irritating.

COUNTERIRRITANTS

"In medicine, a substance or an appliance employed to produce an irritation in one part of the body in order to counteract or remove a morbid condition existing in another part. The term is more specifically applied to such irritating substances as when applied to the skin redden or blister it or produce pustules, purulent tissues, etc." (Century Dictionary.)

The use of counterirritants in eye diseases is very limited. In certain deep-seated and painful inflammations they are occasionally used. The point of application is usually the temple or sometimes back of the ear in the mastoid region.

The commonest counterirritants are mustard, cantharides or Spanish flies, turpentine, croton oil, tartar emetic, tincture of iodin, and the actual cautery. Setons, which were formerly used, have been given up.

CAUSTICS

"In medicine, any substance which burns, corrodes, or disorganizes the tissues of animal structures. An escharotic." (Century Dictionary.)

The word "caustic" is derived from a Greek word which means "to burn."

Nitrate of Silver or Silver Nitrate.—This is very frequently used either in strong solution, or in the form of the solid crystals, or mixed with potassium nitrate. This last is sometimes cast into a stick, which goes under the name of the "mitigated silver nitrate." Silver

nitrate was formerly called by surgeons, "lunar caustic." A convenient method of using silver nitrate as a caustic is to heat an applicator made of iron or other metal and fuse a crystal of silver nitrate upon the end. The bead of silver nitrate formed in this way may be as small as desired, and has the advantage that it is not as brittle as the crystals.

Caustic potash or **potassium hydrate** is a hard white brittle substance which is easily dissolved in water. When exposed to the air it soon absorbs moisture from it and deliquesces or "melts." It must, therefore, be kept in a bottle tightly corked, so as to exclude the air. If caustic potash is applied to the skin the skin is destroyed (cauterized) at the point of application. In case of entropion (turning in) of the lower lid the condition can sometimes be remedied by applying caustic potash to the skin below the lid, in a line parallel to the edge of the lid and a few millimeters from the edge. The scar formed in healing draws down the edge of the lid so that the defect is remedied. If the effect is not sufficient at the first application, a second may be made.

Caustic soda or **sodium hydrate** has an action similar to that of caustic potash.

Carbolic Acid.—In the treatment of corneal ulcer carbolic acid is frequently used as a caustic. For this purpose the carbolic acid is used in full strength.

Tincture of iodin acts as a much milder caustic in treatment of ulcer of the cornea.

Bichlorid of mercury in strong solution is a caustic, but its action is limited for fear of poisonous effects.

The Actual Cautery.—This consists in burning or cauterizing the tissues by the application of heat. For

the eye a convenient method is to heat a probe red hot in the flame of an alcohol lamp. It is best to use a probe made of platinum, as this may be heated again and again without being corroded. Another method of applying the actual cautery is by means of a platinum tip heated to a red or white heat by the passage of a current of electricity. This is called the "galvanocautery." A third method is by means of a tip heated by burning naphtha vapor. The apparatus most frequently used for this is the co-called "Paquelin cautery." This form of cautery is more useful in other parts of the body where the surface to be cauterized is more extensive.

ANESTHETICS AND ANODYNES

The word "anesthetic" is derived from a Greek word meaning "without sensation," and the word "anodyne" from another Greek word meaning "freeing from pain." Both words are used either as adjectives or nouns. Thus, we speak of an anodyne poultice or the anesthetic effect of ether. As a noun, we say: "Hot water is an anodyne; ether is an anesthetic."

Anesthetics not only take away sensation, but frequently relieve pain at the same time. Anodynes may relieve pain without taking away sensation. They are not given unless pain is present. Anesthetics are frequently given when there is no pain in order that the patient may undergo an operation without suffering. According to this definition, anesthetics are anodynes, but anodynes are not anesthetics, except that in the case of some anodynes, as opium and its preparations, a sufficient amount may be given to cause anesthesia—*i. e.*, freedom from sensation as well as freedom from pain.

Local Anesthetics.—Anesthetics may be divided into two classes—local and general. Local anesthetics are those which produce a loss of sensation only in the part to which they are applied. On a mucous surface they may be applied with a dropper, as is generally done in the eye, or with a bit of cotton wound on a probe or applicator and saturated with the solution, as is generally done in the nose and throat. In other situations the local anesthetic may be injected under the skin with a hypodermic syringe, as the local anesthetics have little effect upon a surface covered with skin. When injected into the flesh in this way the solution is soon taken up by the blood and distributed through the system. It is, therefore, necessary to work rapidly before the anesthetic effect is lost, and, moreover, care must be taken not to inject a quantity sufficient to do harm constitutionally.

The local anesthetic which is most frequently used in the eye is cocain. This is an alkaloid derived from the plant coca erythroxylon found in South America. There are three very different plants which are often confused on account of the similarity of names. That on which the cocoanut grows is a tall palm tree, called cocoa-palm. The second is a smaller evergreen tree, called the cocoa tree. This is the tree which produces the cacao or cocoa from which chocolate is made. The third is the coca erythoxylon. This is a bush or shrub and the alkaloid cocain is extracted from the leaves. The preparation generally used is the hydrochlorate of cocain, which is in the form of white crystals. For use in the eye these crystals are dissolved in water. The strength of the solution of cocain for use in the eye

is generally from 2 to 4 per cent. In some cases an 8 per cent. solution is used. The solution is dropped into the eye at intervals of five minutes for fifteen minutes to a half-hour. The effect of the cocain is to whiten the conjunctiva by contracting the small blood-vessels and forcing out the blood. The pupil is also dilated and the eyelids are drawn wide open, so that the eye sometimes has a staring appearance. The anesthetic effect of the cocain passes away generally within half an hour, although the pupil may remain dilated for some hours. The dilation of the pupil is not associated with loss of the power of accommodation or, at the most, the loss of accommodation is very slight.

In case the eye is inflamed, adrenalin or suprarenalin solution may be first dropped into the eye to drive out the blood, and then the cocain will act more effectively.

Sometimes cocain-poisoning is encountered, but this happens very rarely in eye practice, because the amount used is so very small. The symptoms of cocain-poisoning are given under the heading Nurse's Duties in Emergencies, on p. 62.

Holocain hydrochlorate and eucain hydrochlorate are synthetic compounds used in a similar manner and having an effect similar to cocain hydrochlorate.

Freezing.—The rapid evaporation of ether and other volatile liquids produces intense cold, and local anesthesia is produced by directing a spray of ether upon the surface to be anesthetized. The effect of the cold is to benumb the nerves of sensation over the part to which the spray is applied. This method of producing anesthesia cannot be applied to operations upon the eye.

General Anesthetics.—These differ from local anes-

thetics in that they not only produce a loss of sensation but also a loss of consciousness. In certain operations on the eye this is a serious disadvantage, especially in operations upon the muscles of the eyes. When these operations are done under cocain the patient retains consciousness and the muscles are under the control of the will. Under a general anesthetic the eyes wander about without control, and the operator cannot judge accurately as to the effect obtained. The nausea and vomiting which frequently follow the administration of ether may cause a hemorrhage, or loss of vitreous after such an operation as cataract, and so ether is never used for such an operation unless the patient is uncontrollable.

Nitrous oxid gas is used for certain operations requiring only a short time. It is also used to anesthetize the patient before the administration of ether. As soon as the patient is unconscious from the nitrous oxid gas, the ether is applied and the time of ether anesthesia is thereby shortened.

Chloroform is preferred by some surgeons to ether in cases where there is no evidence of disease of the heart.

Anodynes.—In medicine, the word "anodyne" is applied to any drug or application used to relieve pain. In certain painful conditions of the eye the local anesthetics may also act as anodynes by relieving the pain.

Heat and cold are often used for the relief of pain—*i. e.*, as anodynes.

Tincture of opium was formerly used as a local anodyne, but now is rarely so used. Opium and its preparations are, however, used internally for the relief of certain

painful conditions. Morphin sulphate, an alkaloid of opium, is sometimes administered hypodermically when the local anodynes fail.

Poultices are anodyne in their action, but are not now used, as in many cases eyes have been destroyed by their use.

MYDRIATICS AND MYOTICS

The word "mydriatic" is derived from a Greek word meaning "enlargement of the pupil." The term is applied to those drugs which have the effect of producing dilatation of the pupil. When used in the treatment of the eye they are used in solution and dropped into the eye with a medicine-dropper.

Atropin Sulphate.—This is the alkaloid of the drug belladonna. This word belladonna is from two Italian words meaning "beautiful lady," because the drug has been used for the purpose of enlarging the pupil to give brilliancy to the eyes. The botanic name of the plant is Atropa belladonna, and from these two are derived the names of the drug, belladonna and its alkaloid atropin.

Atropin sulphate is used in the strength of 1 per cent. for adults, and ½ ro ¼ of 1 per cent. for children. As the drug is extremely poisonous it must be used with great care and kept where it cannot be accidentally swallowed. The drug is so powerful that in a very susceptible patient $\frac{1}{100}$ gr. may produce dryness of the throat and $\frac{1}{50}$ gr. may produce symptoms of poisoning. When used in the eye local poisoning sometimes follows. Even a single drop of a ½ per cent. solution will sometimes cause local poisoning. The symptoms of local poisoning from atropin are a redness and thickening of the lids, espe-

cially the lower lid. The appearance resembles that of ivy-poisoning or of eczema. When this occurs it is necessary to give up the use of the drug, for the poisoning will recur every time the drug is used. The application of carbolized vaselin is perhaps the best treatment for this local poisoning (United States Dispensatory). When general poisoning occurs the symptoms are: Dryness of the mouth and throat, flushing of the face, burning in throat and stomach, great thirst, difficulty in swallowing, nausea and retching, loss of vision, dizziness, and delirium; sometimes violent gestures and fits of laughter, followed by coma, a feeble pulse, cold hands and feet, twitching of muscles, deep coma, and sometimes convulsions followed by death.

Several other mydriatics are used at times instead of atropin, but they need only be mentioned here.

Atropin, hyoscin, hyoscyamin, and duboisin all have the same chemic formula, but there are some slight differences in certain characters, and especially in their effects as mydriatics, some acting more quickly than others and the effect passing off more quickly with some than with others. These are all derived from plants, Atropa belladonna, Datura stramonium, Hyoscyamus niger, and Duboisia myoporoides.

Euphthalmin and homatropin are synthetic preparations which dilate the pupils quickly, and the effect passes off within twenty-four hours.

Cocain hydrochlorate also acts as a mydriatic, but does not, like the other mydriatics, paralyze the accommodation.

Myotics.—These are remedies which are used to contract the pupils. The most important one is eserin,

which is generally used in the strength of 1 to 2 gr. in 1 ounce of water. The other myotic which is commonly used is pilocarpin hydrochlorate, which is much less active in its effects than eserin.

Other Remedies.—Jequirity is a remedy used in the treatment of pannus. Jequirity is a bean found in South America, and has the effect of producing a severe inflammation when introduced into the eye. Following this inflammation there is a profuse purulent discharge from the eyes, and when this has run its course and subsided, the pannus will be found to be lessened and, perhaps, wholly cleared away. In the course of the discharge the eyes are treated in the same way as in the case of purulent ophthalmia. The drug was formerly applied in the form of a solution, or rather, the ground bean was in suspension in water, but now the approved method of application is by dusting the dry powder on the lids.

Leeches.—In certain cases of inflammation, especially of painful inflammation of the eye, great relief is obtained by applying a leech to the temple and drawing away blood from the inflamed tissues. To force the leech to bite at the point desired it may be placed in a test-tube, the open mouth of which may be held against the temple, and withdrawn when the leech has taken hold. Another method is to wrap the leech in a towel, leaving only its head free. In case the leech does not bite readily, the skin may be scarified at the point where it is to be applied.

CHAPTER XIII

COMMON REMEDIES (CONTINUED)

Heat and Cold.—These are very effective remedies in various conditions of the eye. Their use as antiseptics has been described in Chapter II under the heading Antiseptics, and as Anodynes in the preceding chapter.

Heat.—In addition to the uses referred to as antiseptic and anodyne, heat is also used to reduce inflammation, and to bring about the absorption of the products of inflammation and of blood which has exuded into the tissues. Heat may be applied either moist or dry.

Dry Heat.—Some of the methods of applying dry heat which are used in other parts of the body are not available for the eye on account of their weight. Even the hot-water bag has a very limited use on this account. In some cases a small bag may be used. Instead of the hot-water bag a coil of rubber tubing is sometimes used, through which a stream of hot water of any desired temperature is kept flowing. Cloths folded several thicknesses or cotton wool may be heated in the oven and laid on the eyes. These, of course, must be changed as often as necessary to keep up the proper temperature.

Where the electric current is available heat may be applied by electric heating pads, which can be attached by means of a cord to any electric-lamp socket. The degree of heat may be modified by placing as many

layers of cloth as may be necessary over the eye, so that the skin may not be burned.

Moist Heat.—This may be applied by dipping cloth, gauze, or pledgets of cotton in water at the temperature of about 120° F. and laying them over the eye. The

Fig. 20.—Use of the electric heater in keeping at the proper temperature the water for heating the pads in applying moist heat.

excess of water should be wrung out before applying to the eye. The water may be kept at a nearly uniform temperature by placing an alcohol lamp under a basin containing the water. The basin may be placed upon any support to hold it at the proper distance above the lamp, and the size of the lamp flame may be regulated

by raising or lowering the wick so as to increase or diminish the heat. A bath thermometer should be at hand, so that the temperature of the water may be kept at the proper point. Fig. 20 represents the use of the electric heater in keeping the water at the proper temperature and the manner of applying the pads, which in this case were of absorbent cotton, and the nurse is represented as squeezing out between her hands the excess of water.

There should be sufficient thickness to the cloths or cotton to retain the heat for a reasonable time. These should be changed on the eye every thirty to sixty seconds, and the application, as a rule, should not be kept up more than ten or fifteen minutes at a time, and not more than once an hour, for fear of blistering the skin. This danger may be lessened by applying vaselin to the lids before using the hot water. A piece of oiled silk may be laid over the eye as an additional precaution.

Cold.—The use of cold as an anodyne has already been referred to. Following are the methods generally used in applying cold to the eye.

Dry Cold.—The best mode of application of dry cold is by means of the rubber coil, through which ice-water or water of any desired temperature may be allowed to flow. A metallic coil, called the Leiter coil, made of proper size and form to place over the eye, may be used in place of the rubber coil. In using the metallic coil a piece of gauze should be placed over the lids, so that the metal shall not come in direct contact with the skin. Sometimes cracked ice is placed in a small rubber bag and laid upon the eye, but the plan is objectionable on

account of the weight, and also the degree of cold may be too severe.

Moist cold is best applied by means of cloths, gauze, or cotton, which have been first moistened and then cooled by placing them on a cake of ice. The best material for these pads is surgeon's lint, which is best prepared by cutting into circles about 2 inches in diameter. These are then folded once with the rough side inward and moistened and placed upon the block

Fig. 21.—Cold eye-pads.

of ice. If surgeon's lint is not available, soft cotton cloth may be used. This may be cut into squares 4 inches each way and then folded twice, so that when folded they will form squares made up of four thicknesses of cloth and measuring 2 inches in each direction. If two corners are now trimmed off with the scissors so as to make the shape approximately semicircular, the pad will fit better over the eye (Fig. 21). Absorbent cotton, which is sometimes recommended for this purpose, soon

mats together in a wad if handled when moist, and, therefore, does not serve the purpose as well as either surgeon's lint or soft muslin. Gauze may be used, but there should be six or eight layers to make a pad of sufficient thickness.

If one eye is to be treated with the iced cloths there should be at least six pads at one time placed upon the block of ice, and these are to be picked up in regular order and placed on the eye. After the first pad has rested on the eye for perhaps fifteen seconds, it is to be placed back upon the ice and the second pad placed on the eye. The more frequently the cloths are changed the greater will be the effect of the cold. From fifteen seconds to half a minute is the usual interval for changing the pads. If the pads are taken in regular order, the pad which is used will always be the one which has the been the longest on the ice and, therefore, the coldest. When the end of the row is reached, start back at No. 1 again. If both eyes are affected, the pads may be arranged on the ice in two rows and picked up a pair at a time and conveyed to the eyes.

The pads should be moist, but not wet enough so that water will run down over the face. A towel should be placed by the side of the patient's face to catch any water which may run down. If the cold applications are to be continued for a long time, it is well to anoint the lids with vaselin before applying the iced cloths.

Inunctions.—Medicines, as a rule, are not absorbed through the unbroken skin. There is, however, one way by which they can be introduced through the skin, and that is by combining the medicine with some form of

fat, such as lard, tallow, or vaselin. By means of rubbing, the fat may be forced through the skin, and with it the medicine which is combined with it.

Certain diseases of the eye are dependent upon a condition of the blood which requires inunctions of a mercurial ointment. It is, therefore, important that a nurse should know how to use the inunction. In order to be effective it is necessary that the ointment be thoroughly rubbed in. Of course, the physician will prescribe the amount to be used. The rubbing must be continued until the surface is dry. This may require from twenty minutes to half an hour. The inunction must be applied on a different spot each time. If applied to the same spot twice in succession or too near together the skin will be made sore. It is best to choose a spot on the surface where the skin is as tender as possible, as, for example, on the inner rather than the outer surface of the arm, leg, or thigh. The inunction may be applied to the upper arm on one day and to the forearm the next day. On the third day the other upper arm may be taken, and so on, using a new spot each time. The physician should see the patient often, as it is necessary to stop the inunction at the first evidences of salivation. The nurse's hand must be protected by means of a rubber glove while applying the inunction, otherwise the nurse may absorb as much of the drug as the patient receives. The patient may, however, be instructed to use the inunction upon himself, and in that case, of course, it is not necessary to protect the patient's hand.

A Modified Hot Pack.—Hot packs are used in conjunction with the internal and hypodermic injection of pilocarpin hydrochlorate to aid diaphoresis in certain

abnormal conditions of the eye, especially those relating to the fundus.

Cover the bed with a hot dry blanket, remove the patient's nightgown, fold the blanket around the patient, tucking it in around the shoulders and feet. Protect the hot-water bags with covers; place one at the feet and two or three on each side. Have several extra blankets over the patient, an ice-cap or ice-compress on the head. Give the patient hot drinks. Pulse (at the temporal artery) must be carefully watched for any depressant effect. Leave the patient in the pack from one-half hour to two hours.

At the end of that time give the patient an alcohol rub, remove the ice-cap and blanket around the body, and all but one hot-water bag; put on a warm nightgown and gradually remove the extra blankets.

CHAPTER XIV

EVERSION OF LIDS; RETRACTORS; DROPS, SOLUTIONS, OINTMENTS, AND SALVES

Eversion of the Eyelids.—The eversion of the lower lid is a very simple matter. Place a finger or thumb upon the lower lid, just-below the lashes, and direct the patient to look upward and at the same time press down-

Fig. 22.—Eversion of the upper lid.

ward with a finger, and the edge of the lid will roll outward, exposing the conjunctival surface.

Eversion of the upper lid requires some practice, but a nurse who is to attend eye cases should learn the art

as soon as opportunity offers. First direct the patient to look downward without inclining the head forward, and at the same time grasp the lashes of the upper lid between the thumb and forefinger of one hand, and with the other hand place a small pencil, penholder, or applicator horizontally along the upper part of the lid

Fig. 23.—Eversion of the upper lid.

(Fig. 22). Then draw the lid downward and forward and at the same time press the pencil or applicator downward with the other hand. After practising until it is easy to turn the lid by this method, a finger may be substituted for the pencil (Fig. 23), and, perhaps, after a time sufficient skill may be acquired so that the lid

may be turned with one hand alone without the assistance of the other hand. The nurse may stand either behind the patient or in front, as shown in the illustrations.

The majority of patients when told to look downward will incline the head forward without relatively changing the position of the eyes. It is, therefore, necessary to impress upon the patient that he must turn the eyes downward without moving the head, and, moreover, he must continue to look downward as long as it may be necessary to keep the lid everted, because if the patient looks upward suddenly, even after the lid has been successfully turned, the lid will be immediately turned back to its natural position. The reason for this will be seen from what we have learned under the anatomy of the eye, that the conjunctiva which lines the lid is continuous with that which covers the front of the eyeball, and, therefore, when the eye is turned upward the conjunctiva of the upper lid is also drawn upward, and the tension on the conjunctiva causes the lid to turn inward.

Sometimes the eyelids are devoid of lashes and the conjunctival surface is contracted on account of scars from old trachoma or perhaps from a lime burn. Sometimes the entire lid is thickened, especially in cases of acute purulent disease. Such lids are very difficult and sometimes almost impossible to turn.

Lid Retractor.—When an eye with tight or swollen lids is to be cleansed it is necessary to raise the lids from the eyes with an instrument called a lid retractor.

The retractor must be carefully introduced under the upper lid in such a way as not to injure the cornea. A

finger or thumb of the other hand is used to press down the lower lid at the same time that the retractor draws the upper lid upward. In this way the eye may be inspected to see if there are corneal ulcers or abrasions and irrigating solutions may be used to cleanse the eye. Several forms of retractors have been devised through which a stream of water may be forced, so that when

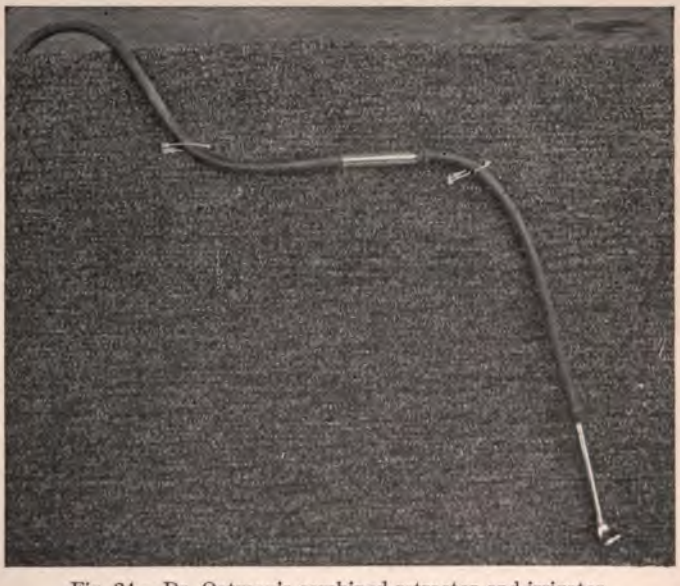


Fig. 24.—Dr. Oatman's combined retractor and irrigator.

the lid is raised by the retractor any secretion present may be washed out.

When the lid is raised by the ordinary form of retractor any secretion present may be washed out by means of a bulb syringe with a soft-rubber tip, or by means of absorbent cotton saturated with the solution which has been chosen for the purpose. This is best accomplished

when the patient is lying on a bed or couch or in a reclining chair with the head thrown well back. In treating children who object to the treatment it may be necessary to hold the child's head between the knees. This will be more fully treated under the heading Management of Troublesome Children.

In **applying drops to the eyes** the best method is to draw down the lower lid with the finger of the left hand, directing the patient to look upward, as described under the heading Eversion of the Lower Lid. Then, with the dropper in the right hand, allow a drop to fall upon the inner surface of the lid. The drop will enter the eye just as effectively in this way as if it were allowed to fall directly upon the surface of the eyeball. This method is much more agreeable to the patient, as it is startling and sometimes painful to have a drop fall directly upon the sensitive cornea.

In instilling drops into the eyes the point of the dropper should never be allowed to come in contact with the lids or eye, as some of the secretion from the eye might adhere to the dropper and so carry contagion to another patient. It is best in every case to draw up into the dropper only so much of the solution as is to be used, and then to rinse out the dropper by drawing sterile water in and out before replacing the dropper in the bottle.

The bottles containing the solutions to be dropped into the eyes are generally made for hospital use in such a way that the dropper itself forms the stopper of the bottle. For this reason the dropper need never be laid down where it may be contaminated by germs, and there is no danger that a dropper which has been used

for one kind of solution should be used for another kind.

Care of Bottles and Solutions.—Bottles and droppers are cleansed by washing in soapsuds, and if there is any deposit in the bottles or pipets, use hydrochloric acid 1:3 or 1:6, being careful to rinse thoroughly. The rubbers must, of course, be removed from the droppers. Sterilize by boiling or by soaking in bichlorid of mercury (1:500) over night or at least for one or two hours Some find a deposit after boiling, which they claim is not present if soaked in the bichlorid solution. Boiling is better for operating room purposes.

Solutions are made up from distilled water; bottles are filled and sealed for operating room use and are not used a second time. For ward use it is well for each patient to have his own tray with solutions, and only changed if not perfectly clear. Some believe that solutions may be filtered and boiled or sterilized. Others believe that atropin and cocain are changed by heat. Some of the solutions are changed by the action of light. Eserin solution is changed to a pink tint and cocain solution to a blue tinge, and then they are not suitable for use in the eye.

Droppers should never be inverted so that the solutions will come in contact with the rubber, as rubber cannot be perfectly sterilized and there may also be a chemic change. Solutions of nitrate of silver soon undergo a chemic change on exposure to the light, and should be kept away from the light and in bottles of dark glass.

For the sake of economy only small quantities of solutions should be prepared at one time.

In **applying ointments to the eyes,** if it is desired to

have the ointment reach the eyeball itself, the lids are held slightly apart by the fingers of one hand, and the ointment, as much as has been directed by the physician, is to be placed between the lids by a finger of the other hand or by a small spatula. Some prefer to wind a bit of cotton tightly upon a probe or wooden toothpick and, taking the salve on this, wiping it off between the lids. In any case, after the salve is placed between the lids, a gentle massage of the lids should be employed to spread the salve over the surface of the eyeball.

If the salve is to be applied only to the edge of the lids, the lids should be first thoroughly cleansed and all scales and crusts removed. The salve is then spread over the edge of the lid with the finger. For cleansing the lids as a preparation for the application of the salve a solution of borax (about ½ teaspoonful to 1 cupful of hot water) is generally used.

CHAPTER XV

CONTAGIOUS EYE DISEASES. THE NURSE'S DUTIES AT OPERATIONS

ATTENTION has been called elsewhere to the definition of the terms "contagion" and "infection;" hence, it is not necessary to repeat what contagious or infectious diseases are. We may add, however, that contagion is spoken of as "direct" when, for example, the discharge from an inflamed eye is ejected into the eye of one who may be examining it; or "indirect," as when an eye becomes affected by poisonous material carried into it by means of a towel, sponge, or other agent.

For all practical purposes it is sufficient that a nurse should regard every disease of the eye which is accompanied by a discharge as contagious, and when called upon to attend such a case should take every precaution against the carrying of the contagious material to fresh soil. Some diseases of the eye are more contagious than others. Of these may be mentioned gonorrheal ophthalmia and ophthalmia neonatorum, which are analogous diseases and are intensely contagious, requiring the most extreme care in their handling.

The proper management of one of these cases calls, first of all, for isolation, and a separate chamber should be provided and properly prepared for the patient (see Chapter III). Should the circumstances of the family be such that this is impossible, the case should be removed

to an ophthalmic hospital possessing accommodations for contagious diseases; and if such an institution is not available, the nurse must devise the best means in her power to ensure the safety of those whose presence in the vicinity of the patient is unavoidable. Having arranged these preliminaries, the nurse will proceed to carry out the instructions of the physician in charge; putting on a gown sufficiently voluminous to cover her costume entirely, and wearing goggles to protect her own eyes. It is safe to say that the first, and one of the most important, of the physician's orders will be to cleanse the eyes frequently, by which is meant to keep the external portions of the eye and the conjunctival sac as free from secretion as possible. The nurse should know how to do this in case no specific instructions are given her, and the following method is recommended:

In the case of adults, the bedclothing, pillows, etc., are protected with towels, and a basin is placed in position against the side of the head to catch the excess of solution used to cleanse the eye. A bowl of warm boric acid lotion, or whatever other cleansing agent has been ordered, is placed near at hand, and the liquid is conveyed to the eye either by means of pads of absorbent cotton or gauze or in a rubber bulb irrigator. With the fingers and thumb of the left hand the eyelids are separated as gently as possible while a stream of solution is allowed to run into the conjunctival sac and out into the receiving basin with just sufficient force to dislodge the particles of secretion. For irrigating purposes a number of devices have been recommended and used, the irrigator mentioned above being one of the simplest and best. It consists of a hollow rubber bulb fitted to a

short glass canula smoothed and rounded at the tip. This may be moved about with ease until all parts of the conjunctival cul-de-sac have been reached. Moistened pledgets of absorbent cotton are used to wipe away small particles of adherent discharge. The nurse will have been instructed, it need scarcely be said, in the simple procedure of everting the lids, and when this can be done with sufficient ease to avoid injuring the corneal epithelium it will form the preliminary step in the cleansing process. But not seldom the lids will be found so greatly swollen (chemosis), or so stiffened by the character of the inflammatory process, that recourse must be had to a lid retractor in order that the field of operation may be disclosed. The lid retractor is an instrument designed to effect the raising of the upper lid. It must only be employed by those who have had instruction in its use, and then with extreme care, as by clumsy handling very serious injury may be done to the cornea. The lid retractor and also the combined retractor and irrigator have been described on p. 138.

In cases where only one eye is inflamed, the other must be protected from infection by a Buller's shield. This little appliance will be found illustrated in the chapter on Instruments, with instructions as to its adjustment.

When the patient is a small child, it may be necessary to wrap it about with a sheet in order that its hands may not come in contact with the eyes, and also that the process of cleansing the eyes and applying remedies may be carried out effectually. An illustration is given elsewhere in this volume showing a child thus arranged. Otherwise the procedure is the same as for an adult.

In addition to cleansing the eyes, it will be the duty of the nurse to instil drops or carry out any other line of treatment ordered; then, having performed these offices, she must again render herself surgically clean before undertaking any service for another patient or coming in contact with anyone. Thus, the protective gown must be removed and sent for resterilization, the goggles discarded, and the hands and arms subjected to that thorough disinfection which has been described elsewhere.

Finally, it is well that the nurse should be prepared for such an emergency as the accidental introduction of a drop of discharge from an inflamed eye into one of her own or into the eye of some one standing near by, possibly assisting. No surgeon may be near and promptness is of supreme importance when this accident happens. The upper lid should be everted and the conjunctival sac thoroughly irrigated with a solution of bichlorid of mercury (1: 5000), after which a few drops of a 2 per cent. solution of nitrate of silver should be instilled into the eye. These measures will usually be successful in averting any serious consequence from the accident. Nevertheless, it is advisable that until such favorable termination is reasonably certain the other eye should be protected carefully.

The Nurse's Duties at Operations

The nurse's duties preparatory to and during operations on the eye are important, and should be carried out to the letter. Antisepsis—or the methods employed in the production of that condition called "asepsis"—is of value only in so far as it is complete. "A

chain is no stronger than its weakest link," therefore it is obvious that if we would assure, as far as in our power lies, the success of an operative procedure, we must not neglect the smallest matter in the detail of our preparation for each separate operation. Of course the prime responsibility must rest upon the surgeon, but only less important are the duties which devolve upon the nurse in charge.

With reference to the patient, it is assumed that if it is a hospital case, he has been bathed thoroughly and clothed in garments suitable for remaining in bed. Except in old people the intestinal tract should be cleared effectively by a brisk cathartic given the day before the operation; should this have been neglected, and should the operation be timed for the afternoon, a saline cathartic may be given on the morning of that day; while in cases where there remains insufficient time for even this, an enema may be given shortly before the operation. In the case of patients of advanced years, surgeons sometimes hesitate to give a cathartic for fear of setting up a troublesome diarrhea, which might prove ruinous to an eye after a delicate operation, such as a cataract extraction; hence the nurse must not assume this responsibility unless under the surgeon's orders. Preparatory to an operation the urine should be voided, and if there are artificial teeth, these should be removed. In the case of women patients, the hair should be combed well up on the top of the head and plaited loosely, so that the bandage (when one is required) may be properly applied, as well as for the comfort of the patient.

When the patient is on the table (the arrangement

and preparation of which is described elsewhere) the upper part of the body, the hair, and sides of the face must be covered with sterilized sheet and towels. The face must then be washed with warm water and Castile or other pure soap, special attention being paid to the eyebrows and eyelashes. The conjunctival sac is then irrigated with a warm saturated solution of boric acid. A convenient instrument for this purpose is an ordinary glass pipet with the edges surrounding the tip rounded so as not to injure the mucous membrane, and having a soft-rubber bulb attached. This bulb is of such a size as to fit comfortably into the palm of the hand; and with a little care every portion of the conjunctival cul-de-sac can be readily reached and cleansed. The eye is then closed and a pad of gauze or cotton wrung out of a solution of bichlorid of mercury (1:5000) is placed lightly over the closed lids. The eye which is not to be operated upon is usually shut and a small oval patch of cotton, covered on both sides with a single thickness of gauze (Knapp's dressing), secured over it with adhesive plaster. In restless patients, or those who experience difficulty in controlling the movements of the eye, the unaffected eye is left open frequently, the surgeon thus securing the co-operation of the patient in rendering the operative measures smooth and uncomplicated. A rubber cap should be drawn over the patient's hair and the head surrounded with sterilized towels, one being laid lightly over the chin and mouth. Some surgeons do not consider their preparation complete until the eyelashes have been clipped close to the lid margin, but the majority content themselves with a careful cleansing of the lashes and eyebrows.

For operations taking place in private houses, a north light should be secured, if possible, and the operating table or bed placed as near the window as is convenient. Occasionally, instead of using a table the surgeon may elect to operate while the patient remains in bed. This has the advantage of avoiding the necessity of moving the patient at the conclusion of the operation, but, on the other hand, unless the bed is unusually high, it compels the operator to stoop considerably and assume an uncomfortable attitude, when he should be at perfect ease.

Unless the patient is very feeble, however, it is better to make use of an operating table; but should the patient be operated on in bed, the mattress should first be covered with a rubber sheet, over which is drawn a sterilized sheet. The room, moreover, should be prepared in accordance with the instructions already given in the preparatory chapter of this volume. Should good daylight be not obtainable, or as an adjunct to it, an electric droplight, fitted with a reflector, will prove valuable in houses wired for electricity. Where gas only is used as an illuminant, a lamp fitted with an incandescent mantle, such as the Welsbach, may be used; or recourse had to a portable electric lamp, such as most surgeons now possess. The furniture should be removed from the room and sufficient space secured for the operating table and for the smaller tables for the instruments and dressings. A stool must be provided for the anesthetist, with a smaller table for his outfit. There should also be ample room for the surgeon and his assistant and one or two nurses, without crowding. Usually, in operations about the eye or its surroundings, there is little

necessity to provide for much bleeding; occasionally, however, this contingency must be considered, when the walls of the room should be protected with sheets to a height of 5 feet or more, and the carpet covered with newspapers spread over with sheets. The tables upon which the instruments, dressings, etc., are to rest should be covered with clean sheets or towels.

The nurse should have ready an 8-ounce bottle of tincture of green soap, with a sterile nail-brush and an orange-wood nail cleaner for each surgeon, a basin of alcohol and one of bichlorid of mercury (1:1000) or whatever other disinfectant the surgeon may select for his hands. There should also be provided a large basin of sterile water, one of normal salt solution, and one of a mild antiseptic solution, usually boric acid. Besides these, the surgeon will doubtless have instructed her to have conveniently at hand sterilized bottles of solutions of cocain (one 4 and one 8 or 10 per cent.), eserin (1 per cent.), atropin (1 per cent.), argyrol (15 to 25 per cent.), and adrenalin (1:1000).

The sterilization of instruments and the preparation of the arms and hands have been gone into elsewhere. It is, perhaps, unnecessary to add that the nurse's uniform should be covered with a sterilized gown and her hair confined within a sterilized cap. Finally, she should see that the dressings, solutions, and prepared pads of cotton for sponging, etc., are not only abundant but also conveniently placed, and she should be careful to move about her duties quietly and rapidly, speaking only when necessary and in a moderate tone of voice, showing every consideration for the feelings of the patient or of friends who may be near.

ANESTHETICS

It is well for the nurse to understand in a general way the rules governing the administration of anesthetics and the after-treatment of patients who have been under their influence. Anesthetics are of two kinds—general and local. Of the former, there are three commonly employed, viz.: nitrous oxid or "laughing" gas, chloroform, and ether. The first named has the advantage of acting rapidly, but its effects are very evanescent, and it is consequently only employed alone for such small operations as the opening of abscesses, passing of lacrimal probes, extraction of teeth, etc. Ether and chloroform, however, produce an anesthesia which is much more prolonged, and are used when painful operations requiring some time for their performance are to be undertaken. There are, of course, certain dangers accompanying the use of general anesthetics, and these have been studied very carefully by those whose business it is to administer these agents habitually; it is sufficient for our present purpose to say that chloroform is more dangerous than ether, and is, consequently, less frequently employed, at least in this country. Ether, on the other hand, is responsible for a more violent "first stage" of the anesthesia and for more nausea and vomiting following its use. By the preliminary use of nitrous oxid the patient is very quickly rendered unconscious, and the anesthesia may then be continued readily with ether. This is a method which is now used widely, and it is undoubtedly the ideal way of producing general anesthesia. The nurse should see that the patient about to be anesthetized wears loose clothing, and that those other precautions mentioned elsewhere have been

attended to. When the patient has been put to bed again, the nurse should remain at the bedside until all traces of excitement accompanying returning consciousness have passed away. Nausea may be controlled by giving the patient small pieces of ice to dissolve in the mouth.

Local anesthetics are used largely in eye practise, and they differ from general anesthetics in affecting only the part to which they are applied. There have been a number of drugs used to produce local anesthesia from time to time, the most important being cocain, eucain, and holocain. Of these, cocain is by far the most generally used and its value is inestimable. For example, in the operation for the removal of cataract, where it is desirable that the conscious effort of the patient should be at the command of the surgeon, and where the nausea and vomiting accompanying general anesthesia might work serious damage, cocain acts perfectly. Its value as a local anesthetic was discovered by Dr. Koller, now of this city, in 1884, and since that time it has been used widely in all small operations; 2, 4, and 8 per cent. solutions are ordinarily employed, and the drug is dropped into the conjunctival sac or upon the cornea at intervals of five minutes for thirty minutes before the operation. Care must be exercised to have the solutions and dropper sterilized, and the surface of the cornea should be occasionally moistened, as the epithelium is apt to become roughened from exposure and may be injured after cocain has been used. In lid operations and in orbital explorations, etc., cocain is frequently used hypodermically, the point of the needle being carefully moved about from place to place while buried under the skin,

in order that as large an area as possible may be reached. The anesthetic effect of cocain, as a rule, passes off in about half an hour.

Some surgeons prefer to use eucain, which is less toxic than cocain, and, moreover, does not dilate the pupil or increase the intra-ocular tension; and holocain, in 1 per cent. solution, is also a favorite with many. It is bactericidal as well as anesthetic. Nevertheless, cocain remains much the most widely used of all the local anesthetics.

CHAPTER XVI

EYE INSTRUMENTS AND APPLIANCES

THERE are a large number of instruments and appliances used in the examination and treatment of eye conditions, as well as in carrying out the numerous operations upon that organ. It is not the intention to give a description of all of these here, but a general idea of the instruments employed in the principal operations will be attempted by means of illustrations, and a brief account of a number of appliances found convenient in manipulations about the eye or treatment of its diseases. Beginning with the latter, we may, first of all, speak of smoked glasses. These are provided by the optician in a variety of shades, one of the most generally useful being that designated as "No. 2 London Smoke." When the object aimed at is to temper the intensity of the rays of light entering the eye, this shade is commonly employed, and answers the purpose well.

The Buller Shield (Fig. 25).—This is an ingenious device, designed by the late Dr. Buller, of Montreal, for protecting the sound eye when its fellow has been attacked by a purulent inflammation. It consists of a watch glass placed between two squares of adhesive plaster, that which is attached to the outer or convex surface being somewhat the larger, and the center of each being cut out so as to allow the glass to be seen through. The shield is placed over the eye to be pro-

tected and the exposed adhesive surface fastened carefully to the skin of the nose, brow, and cheek, an opening being left for the ventilation of the eye at the lower and outer angle. This device, it can readily be seen, enables the patient to use his well eye freely, while at the same time it is protected from the introduction of infective material from the inflamed eye.

Fig. 25.—Buller's shield.

The **Knapp dressing** (Fig. 26) is a very favorite one for covering an eye which has been operated upon. It consists of two oval pieces of gauze, between which is placed a layer of absorbent cotton about $\frac{1}{4}$ inch thick. These pads are prepared in quantity and arranged in pairs for the two eyes in separate packets. In use they are placed lightly over the closed lids and kept in place by strips of adhesive plaster.

Shades, designed to protect the eye from excess of light, are frequently prescribed in preference to smoked

glasses. They are made of different materials and to cover one or both eyes. The most commonly used are made of limp cardboard, covered with black silk, and with tapes or rubber band attached; while others are made with a lining of green material. Objection has been made to the use of cloth-covered shades on the ground that they are apt to be kept about the

Fig. 26.—The Knapp dressing.

house after being used and brought into requisition again should occasion arise, thus tending to spread contagion. To avoid this danger, some ophthalmologists favor paper shades, which are destroyed after being used once.

The **Ring mask** (Fig. 27), which was devised by the late Dr. Frank Ring, of the Manhattan, is an excellent protector for eyes which have been operated upon, and

which it is particularly necessary to preserve from external violence. It is used very extensively after the operation for the removal of cataract, and serves its purpose in these cases admirably. It consists of a broad piece of *papier mache,* which has been molded to the shape of the forehead and cheek, with a slight indenta-

Fig. 27.—Ring mask.

tion over the bridge of the nose and bulging protuberances over the orbital spaces. Being quite firm and of light weight and possessing tapes which attach it snugly to the head, the mask is a decidedly satisfactory article in the surgeon's equipment.

The Priestly-Smith Lamp (Fig. 28).—This is a lamp for use at the bedside, and is an extremely handy device in cases where a bright diffused light in the sick room is

not desired and yet where a proper illuminating apparatus for inspection, changing dressings, or applying medicines to an eye may be necessary. It consists of a polished metal cylindric tube with a cross-piece, at each end of which is a condensing lens. A candle is placed within the tube, the flame being kept at the level of the lenses by means of a spring. This lamp is most convenient, being easily managed with one hand.

Fig. 28.—The Priestly-Smith lamp in use.

Artificial (or Glass) Eyes.—Artificial eyes are used, as is well known, when for any reason the eyeball has been removed. They should not be worn until all signs of irritation resulting from the operation have disappeared. The nurse should know the proper method of putting in and taking out these delicate shells, and for that purpose the following instructions are appended:

To Insert the Eye.—Place the left hand flat upon the forehead, and with the tips of the two middle fingers raise the upper eyelid. With the right hand push the edge of the artificial eye beneath the upper lid, which may now be released by the fingers and allowed to drop upon the eye. The latter must then be supported by the fingers of the left hand, while with the right hand the lower lid is drawn forward and made to secure the lower edge of the shell, thus holding it firmly in place.

To Remove the Eye.—Draw down the lower lid with the middle finger of the left hand. Then, with the right hand, place the end of a small blunt instrument under the edge of the artificial eye, which is made to slip forward over the lower lid, when it will readily drop out. This maneuver must be carried out with care, as the eye can very easily be destroyed by dropping on a hard surface.

Of late years an artificial eye designed by Snellen has come into very general use. It is constructed with a disk-shaped plate to fill in the concavity of the shell. This avoids the irritation from the slightly worn edges which is an objectionable feature of the old-fashioned eye, and prevents the collection of mucus and tears between the stump and the shell.

Bandaging the Eyes.—The subject of bandaging the eyes is an important one, and it is well that the nurse should learn at once that an eye must never be bandaged without direct instructions to that effect from the surgeon. She will soon discover that inflamed eyes are very rarely bandaged, since bandaging renders the eye hot and retains the discharges in the conjunctival sac.

Bandages are used in ophthalmology mainly for protection and occasionally for support. The latter is the case, for example, in some forms of ulceration of the cornea, where perforation of that structure is feared, and the former is the case after operative procedures of all kinds.

There are some special forms of bandage recommended for eye work and quite extensively used by their admirers. Of these may be mentioned the *"Moorfields" bandage*, made of a double fold of linen, 7 or 8 inches long by 3 inches broad, with a notch cut for the nose and tapes at each corner for securing it to the head. Another is *Liebreich's bandage*, made of woven material and fitted with ingeniously arranged tapes, which make it very easy to apply and remove. There is also *Stevenson's "dumb-bell" bandage*—called so from its peculiar shape. Most surgeons, however, prefer to use the ordinary roller bandage, 2 inches wide, made of unbleached muslin or gauze. This is best applied by standing in front of the patient. If the right eye is to be covered, place the external surface of the free end of the bandage in the center of the forehead above the eyebrows. Holding the bandage in the right hand, and securing the end in place with the fingers of the left hand, carry the bandage to the right around the head in such a manner as to give it a firm hold upon the occiput. Reaching the forehead, it overlaps and fixes the free end, and is continued once more around the middle of the back of the head. It is then passed below the right ear and up over the right cheek and eye to the location of the original turns, where it is secured with a safety-pin. This arrangement makes it possible to inspect the eye without

raising the patient's head from the pillow. The left eye may be bandaged in the same way by merely reversing the instructions given above.

A very popular method of bandaging the eyes is by means of what is called the *"figure-of-eight" bandage.* Instructions for applying this bandage, which may be used for one or both eyes, resemble those above given for the single-tour roller, except that the turns are increased in number alternately around the head and diagonally up over cheek and eye, each turn overlapping the preceding one evenly and neatly. When it is used for both eyes, as it commonly is, the first diagonal turn is brought up from below the ear over the eye which has been operated upon, then around the head and down over the cheek and eye on the sound side, and so on, as many times as the surgeon may desire. If the patient is restless, the bandage must be frequently inspected by the nurse, as the movements of the head upon the pillow have a tendency to dislodge the turns which pass around the occiput.

Dressing Tray for Cataract Operations.—For the dressing of cataract cases a tray is prepared containing bowls of warm boric acid and saline solutions, absorbent cotton balls for cleansing purposes, Knapp's dressing, bandages, a condensing lens, solutions of cocain, atropin, eserin, and, frequently, argyrol, and a receptacle for used sponges and bandages. An illustration is given of such a tray (Fig. 29). Some surgeons, instead of using the Knapp dressing, fill the hollows of the orbital spaces with small pieces of moist cotton, carefully placed, and cover the whole with a mass of gauze, securing this with a bandage.

Instruments for Eye Operations.—The instruments most commonly employed in the operation for the ex-

Fig. 29.—Dressing tray for cataract operations.

traction of cataract are shown in Fig. 30 arranged upon a tray.

Fig. 30.—Instruments for cataract extraction.

Following are illustrations of many of the instruments used in eye operations (Figs. 31–35).

Fig. 31.—Principal instruments used in eye operations.

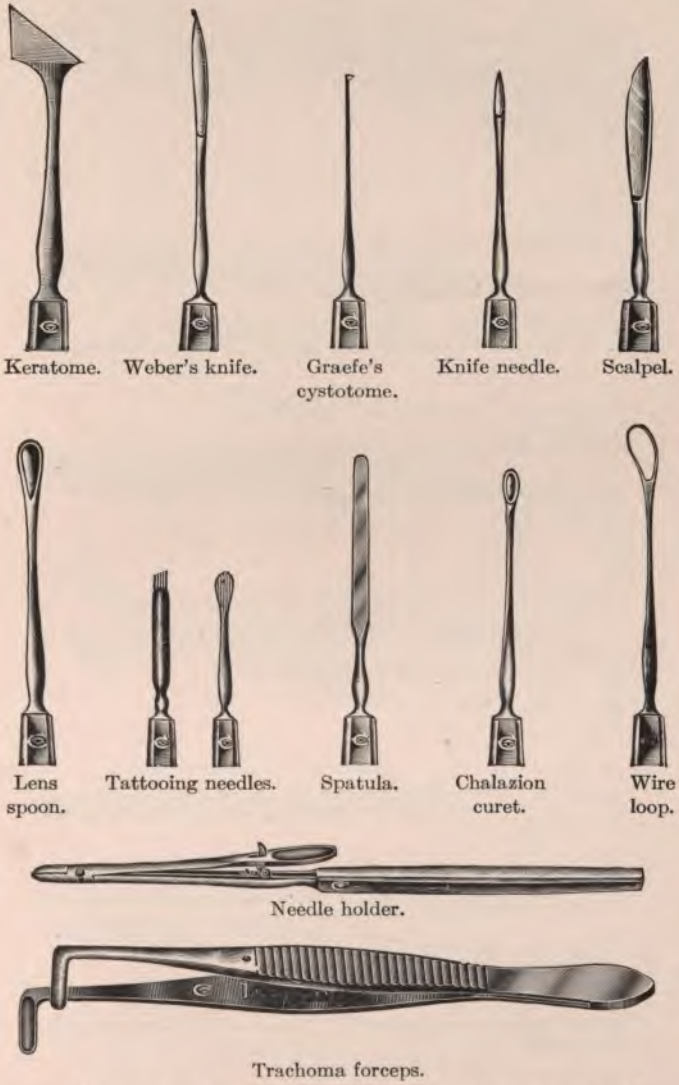
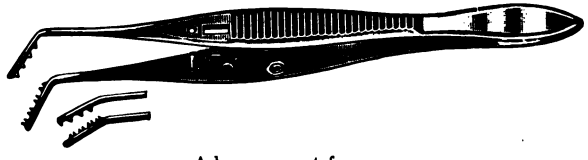
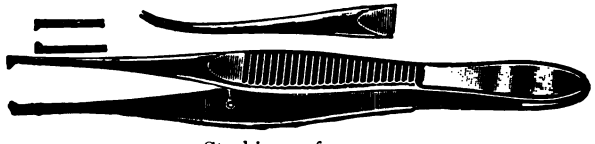


Fig. 32.—Principal instruments used in eye operations (continued).



Advancement forceps.

Tendon forceps.



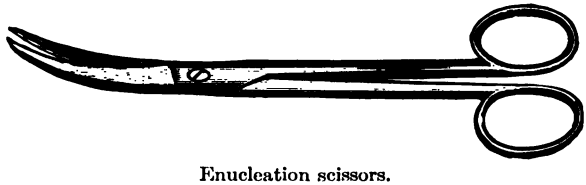
Strabismus forceps.

Iris forceps.

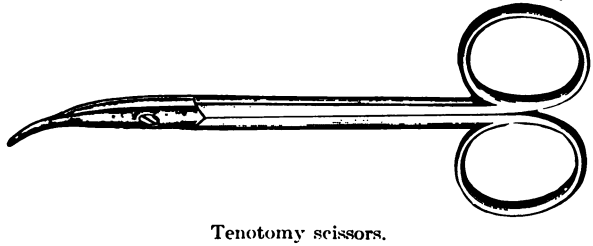
Lacrimal dilators.

Lacrimal probe.

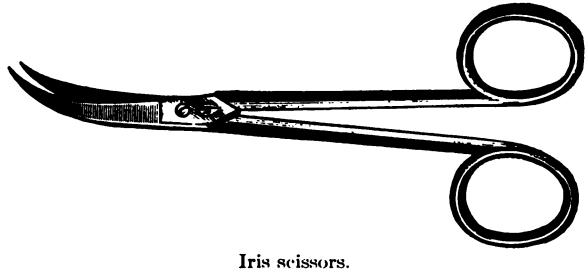
Fig. 33.—Principal instruments used in eye operations (continued)



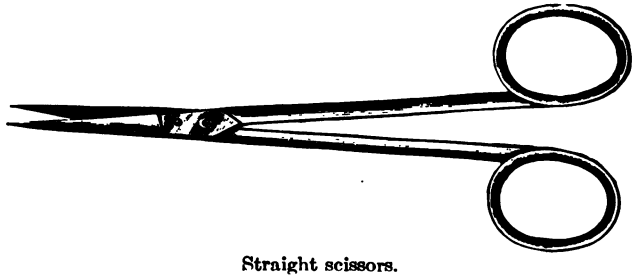
Enucleation scissors.



Tenotomy scissors.

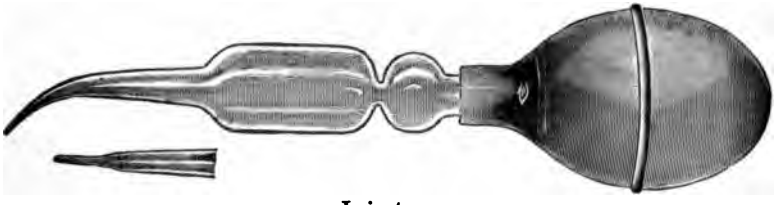


Iris scissors.

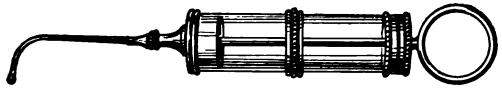


Straight scissors.

Fig. 34.—Principal instruments used in eye operations (continued).



Irrigator.



Lacrimal syringe.

Fig. 35.—Principal instruments used in eye operations (continued).

Other instruments commonly employed are:

Beer's knife.
Pterygium knife.
Grattage knife.
Cilia forceps.
Fixation forceps.
Dissecting forceps.
Snellen's clamp.

III. THE EAR

CHAPTER XVII

OUTLINE OF THE ANATOMY AND PHYSIOLOGY OF THE EAR[1]

THE organ of hearing is best divided for study into three divisions: (1) The *external ear* and *auditory canal;* (2) the *middle ear* or *tympanum;* (3) the *internal ear* or *labyrinth.*

Functionally, the first two divisions are classed together and called the *sound-conducting apparatus,* and the third is called the *sound-perceiving apparatus.*

The **external ear, pinna,** or **auricle,** as it is called, consists of a plate of yellow elastic cartilage, folded and bent on itself to form the ridges and depressions known as the helix, anthelix, concha, etc., shown in Fig. 36, and is covered with a thin and firmly attached skin. The lower portion of the auricle or lobe of the ear is devoid of cartilage and consists chiefly of connective tissue and fat. The cartilage of the external ear is prolonged inward in the shape of a tube from the concha to form the outer two-fifths of the external auditory canal. In adults this external auditory canal is about 1¼ inches long and is narrowest at its middle, which is also the highest point of its floor, for as it runs inward it is directed

[1] The author is indebted to Dr. P. B. Barringer's useful "Abstract of Physiology" for a large part of this chapter.

first upward and forward and then downward and forward to the drum membrane. Therefore, in order to straighten the canal to examine or irrigate it the auricle should be drawn upward and backward. In infants at birth and for some months following, the upper and lower walls of the external canal are in contact, owing to lack of development of the bony canal. Consequently,

Fig. 36.—Right auricle: Nomenclature after Spalteholz (Barnhill and Wales).

up to two years of age the canal is best straightened for examination or irrigation by pulling the auricle downward and backward. As the development of the canal takes place in older children it is straightened by pulling backward and then backward and upward, as in adults.

At its entrance or meatus the canal expands a little in its vertical diameter (ϕ), and at its inner end it

expands horizontally (⊖), in view of which most ear specula are made with oval tubes. The inner end is closed by the drum membrane, which extends obliquely across it, making the anterior wall and floor of the canal longer than the roof and posterior wall. The nerve-supply of the canal, from Arnold's branch of the pneumogastric nerve and from a branch of the fifth nerve, is

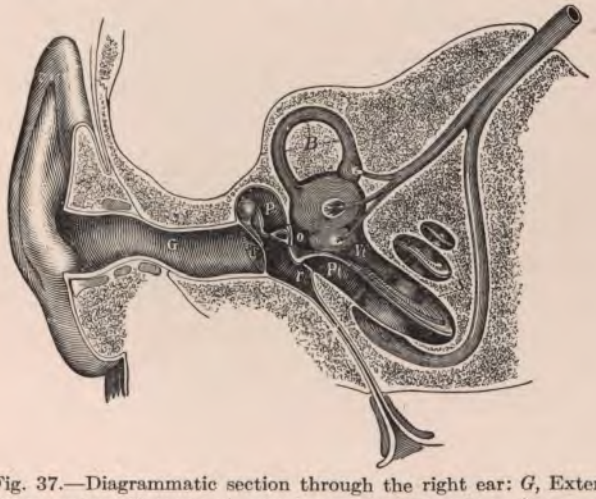


Fig. 37.—Diagrammatic section through the right ear: *G*, External auditory meatus; *T*, tympanic membrane; *P*, tympanic cavity; *O*, oval window; *r*, round window; *B*, semicircular canal; *S*, cochlea; *Vt*, scala vestibuli; *Pt*, scala tympani (Czermak).

interesting because of the reflex coughs and neuralgia caused by hardened wax or foreign bodies in the canal.

The skin of the outer half of the canal contains hair-follicles and ceruminous or wax-glands. The hairs protect it from insects, dust, and extraneous matter, and the cerumen keeps the skin soft.

The muscles that move the ear are in man almost

functionless and serve only as attachments for it to the side of the head.

The **middle ear** or **tympanum** is an irregular cavity about the size and shape of a grain of Indian corn placed on edge with the point forward.

The external wall of the tympanum consists mainly of the drum membrane set in its bony ring, the annulus tympanicus, which is incomplete at the top and at which point the membrane sags, and is called the *membrana flaccida* or *Shrapnell's membrane.* The chorda tympani nerve, supplying the anterior two-thirds of the tongue with taste, crosses on the inner side of the drum membrane, and when a myringotomy (incision of the drum) is performed it is sometimes severed, causing a temporary numbness and loss of taste on that side of the tongue.

The inner wall of the tympanum has two openings through it communicating with the internal ear. These are called the *fenestra ovalis* (or oval window) and the *fenestra rotunda* (or round window). Arching backward from over the oval window and then downward in the posterior wall runs the facial nerve, lying in its bony canal the aquæductus Fallopii.

The anterior wall has in it near the bottom an opening for the *Eustachian tube,* which runs from the middle ear to the throat. Its trumpet-shaped opening into the throat dilates during the act of swallowing and admits air to the middle ear, thus keeping the pressure equal on both sides of the drum membrane. Into the mouth of this tube the catheter is placed when direct inflation of the middle ear is practised.

The posterior wall of the tympanum has near its top an opening into the mastoid antrum called the *aditus.*

Through this opening inflammation may extend from the middle ear to the mastoid cells, causing mastoiditis.

The superior wall is a thin plate of bone separating the middle ear from the brain. The inferior wall is called the floor. The tympanum is lined with mucous membrane, which is continuous with that lining the aditus and mastoid antrum.

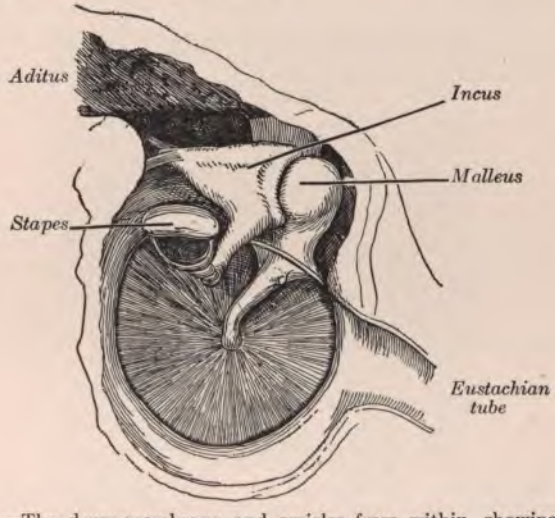


Fig. 38.—The drum-membrane and ossicles from within, showing attachment of malleus handle to drum-head (Pyle's Personal Hygiene).

The upper part of the tympanum behind *Shrapnell's membrane*, level with the *aditus*, is called the *attic*. This region contains the bones of the middle ear (Fig. 38).

The *ossicles*, or bones of the middle ear, are three in number and are called respectively the *malleus*, *incus*, and *stapes* or *hammer*, *anvil*, and *stirrup*. The malleus, the most external bone, has its handle woven into the middle of the tympanic membrane. When sound-

waves strike the ear drum the motion is imparted to the malleus, and by an interlocking union is transmitted to the incus, thence to the stapes, and by its foot-plate, which is woven into the membrane closing the oval window, to the fluid of the internal ear. The muscles of the ossicles are two—the tensor tympani and the

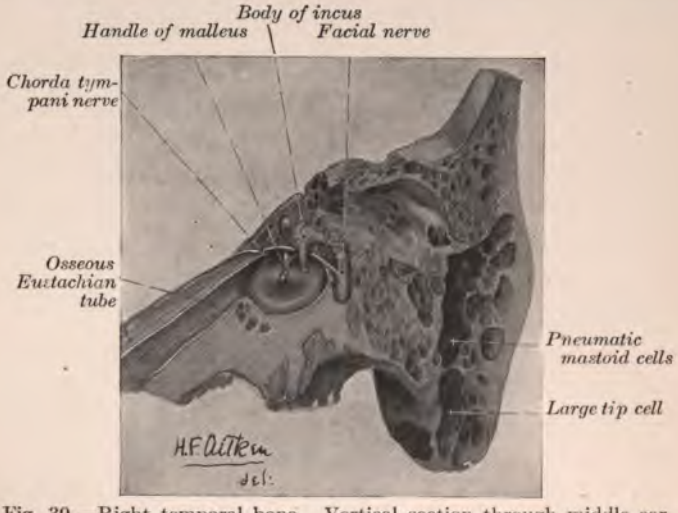


Fig. 39.—Right temporal bone. Vertical section through middle ear, viewed from within (Barnhill and Wales).

stapedius. These, with the ligaments, particularly those between the malleus and incus, are interesting but complicating, and had better be described in an anatomy than in a book on nursing (Fig. 39).

The *mastoid* portion of the temporal bone lies just behind the ear. Its outer surface is rough and subcutaneous, and ends below in a nipple-like tip, called the mastoid process. Its inner surface has a deep groove for the lateral sinus. This is the large vein lying be-

tween two layers of the dura, the bladder-like covering of the brain, which becomes the jugular vein in the neck after passing across the mastoid process like a letter **S,** in close contact with its inner surface, as described above. The importance of this vein in connection with mastoiditis will be seen later on. Between the external and internal surfaces or plates of the bone lie the mastoid cells and mastoid antrum. The latter is separated from the brain above by a thin plate of bone called the tegmen antri (Fig. 39).

Fig 40.—Right bony labyrinth, viewed from outer side: This figure represents the appearance produced by removing the petrous portion of the temporal bone down to the denser layer immediately surrounding the labyrinth (from Quain, after Sömmering)

The **internal ear** or **labyrinth** lies just internal to the tympanic cavity and consists of a central cavity or *vestibule,* a posterior portion formed of the *semicircular canals,* and an anterior portion of the *cochlea. The cochlea is the auditory part of the ear. The canals are chiefly concerned in equilibration. The vestibule is curiously concerned in both.* The bony labyrinth has within it a membranous imitation of its form which is filled

with a fluid called *endolymph.* Around this membranous labyrinth, between it and the bony wall, is a space filled with fluid called *perilymph.*

The vestibule has somewhat the same general shape as the tympanum. In its outer wall it has the foramen ovale filled in by the foot-plate of the stapes; behind are the openings of the semicircular canals; and in front, the cochlea.

The *semicircular canals* are three in number and are located above and behind the vestibule. Each canal describes a little more than a half-circle, and one end of this semicircle is dilated and called its *ampulla.* They are called the superior, the horizontal, and the posterior semicircular canals, and they lie in such a way that each one is at right angles to the other two.

The *superior canal* lies parallel to the sagittal plane of the body and has its ampullated end free in the upper part of the vestibule, but its other end is in common with the posterior canal. The *posterior canal* has its ampullated end opening into the lower part of the vestibule and the other joins the superior canal. The *horizontal canal* is the smallest of the three and has two distinct openings into the vestibule. Its hard, white appearance is an important landmark in the mastoid operation, to show the proximity of the facial nerve

The membranous labyrinth consists of a membranous tube loosely filling each canal, but dilated and closely adherent to the bone of the ampulla. At each end these membranous canals are joined to a membranous sac called the utricle, which lies in the posterior end of the vestibule. This utricle is connected by a Y-shaped tube to a smaller membranous sac in the vestibule called the *saccule,* and the united end of the Y tube passes through the internal wall of the vestibule in a canal called the aquæductus vestibuli to a subdural space. A small tube now unites the saccule with the scala media of the cochlea. These membranous tubes and sacs are held in place by little fibrous processes which run from them to the surrounding bony wall. The vestibular branch of the auditory nerve has little hair-like endings which extend into the cavity of each ampulla,

somewhat similar ones appear in the utricle and saccule, the function of which seems to be as follows: The endolymph is free to move in the canals, so that when any movement is made of the head in the plane of any canal the endolymph of the canal, by reason of its inertia, seems to flow against the movement. This causes a streaming of endolymph through the hair-cells, which, of course, move with the head as they are attached to the side of the ampulla, and a stimulus is given to the nerve-ending through the hair-cells. When a movement in a given plane is long continued the endolymph of that canal is finally set in motion, and this motion continues after the body stops. This causes a sense of vertigo, as seen in children who turn around until they "get drunk."

By the movement imparted to the fluid in these canals and its influence on certain nerve terminals in it we are able to tell "with our eyes shut" our plane of movement in any act.

The *cochlea* lies in front of the vestibule and is a cavity in the bone formed like a small snail-shell, coiled two and one-half times around a central axis. It contains the end organ of hearing and receives the sound impressions, which are carried to the brain and there perceived or interpreted. The method of tone perception is more elaborately explained in fine print, and may be interesting to read, although not necessarily learned.

The tube as it winds around is divided into two parts by a septum, partly bony and partly membranous, which extends from its base almost to the apex of the coil. The inner half of the septum next the central axis is bony, and the outer half is a thin fibrous membrane attached to the outer wall of the tube. The membranous part is called the *membrana basilaris* and supports the famous *organ of Corti*. This septum, as stated, extends from the base of the coil almost to the top and divides the tube into two canals, an upper, or *scala vestibuli*, and a lower, or *scala tympani*, which communicates at the apex, the *helicotrema*.

The lower end of the scala vestibuli, as its name suggests, opens directly into the vestibule, and the lower end of the scala tympani

ends against the *interna tympanic membrane* which closes the round window and separates this canal from the middle ear. In the scala vestibuli is a membrane which rises from the junction of the bony part of the septum with the membrana basilaris, to the outer wall of the tube, and divides it from top to bottom. The triangular space between it and the membrana basilaris is called the *scala media*, is filled with *endolymph* through the *canalis reuniens*, and contains the *organ of Corti*, while the scala vestibuli and scala tympani contain *perilymph*.

The *organ of Corti* lies on the membrana basilaris and contains the tunnel of Corti. This tunnel is formed of inner and outer rod-shaped cells which rest upon the basilar membrane and lean against each other at the top like the rafters of a house, leaving a triangular tunnel below; on either side of this column of rod-shaped cells which form the tunnel there is a line of hair-cells, the inner row being single and the outer triple, while both have the slant of Corti rods. The hair-cells have little hair-like processes extending from their upper surface, and these project through little openings in a membrane which overlies them. Above this is a heavier membrane which just touches the tips of the hair-like processes and seems to act as a damper to excessive vibration.

The cochlear branch of the auditory nerve runs in the *modiolus* or central axis of the cochlea, and sends out branches from base to apex through the bony parts of the septum (lamina spiralis) to receive the impulses of the hair-cells in the organ of Corti.

To explain briefly the function of what has been described above it is best to follow a sound-wave as it passes through the external canal and strikes the drum membrane, where vibrations are conveyed by the chain of ossicles to the oval window. The foot-plate of the stapes then starts in wave motion the perilymph in the scala vestibuli, and these waves pass over to the scala tympani through the helicotrema at the apex of the cochlea and end against the membrane covering the round window. By these waves the membrana basilaris is thrown into motion, and the motion of the membrane is greatest at a certain point that corresponds to the size of the wave. The vibration at this point is recorded by the hair-cells of the organ of Corti and the impulse carried away to the brain by the nerve that receives it at this point, and the impulse is "perceived" as "sound" and the memory of it stored in some center in the brain that receives it. The above theory, although not approved by all authorities, is the one that has been most generally accepted up to the present time.

CHAPTER XVIII

EXAMINATION OF THE EAR: GENERAL METHOD AND INSTRUMENTS COMMONLY EMPLOYED

WHEN the first aural examination is made, the canal, in a large number of cases, may be obstructed by cerumen, epithelial plugs, or some foreign material introduced

Fig. 41.—Syringing an ear.

by the patient in his efforts to relieve pain. This obstruction must necessarily be removed before the drum-membrane can be seen, and the removal may best be

accomplished with least discomfort to the patient by means of a Pomeroy syringe and a warm 10 per cent. solution of bicarbonate of soda. In case the obstruction is from an impacted mass of cerumen, inspissated pus, or epithelium, the plug should be loosened and disintegrated by filling the canal with warm hydrogen peroxid for a few minutes before the injection (Fig. 41).

In using the Pomeroy syringe the auricle should be held between the index and middle fingers of the left

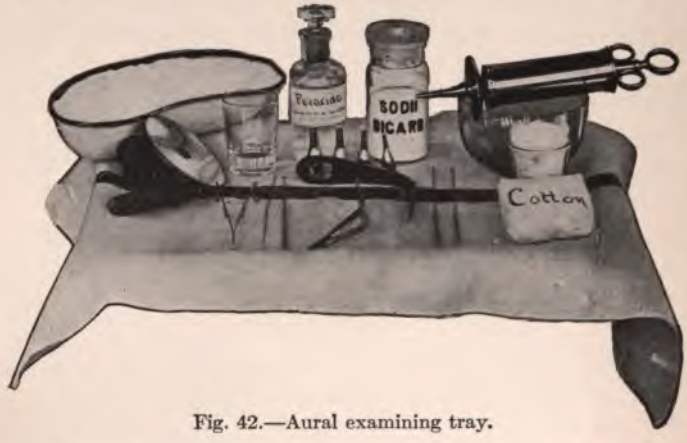


Fig. 42.—Aural examining tray.

hand, leaving the thumb free to act as a rest for the tip. The ear should be drawn upward and backward to straighten the canal (see Anatomy). This method may seem awkward at first, but it has the advantage of holding the tip steady and preventing a jerky contact with a sensitive meatus. The tip should be long and narrow, not bulbous, and when placed just within and against the wall of the meatus should have ample room around it for the return flow. Where the ob-

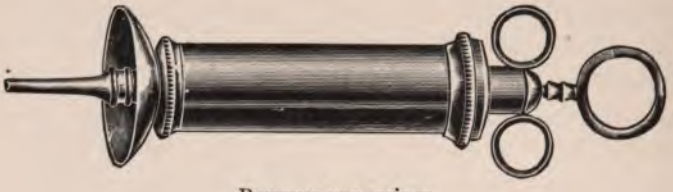
struction does not come away readily the stream should be alternately directed forward, backward, upward, and downward. Persistence and patience and a large quantity of soda solution will almost invariably remove the plug.

The equipment of an **aural examining tray** (Fig. 42) should include.

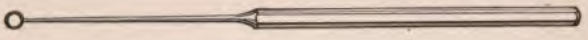
(1) Head mirror.
(2) Full set of ear specula.
(3) Cotton applicators.
(4) Sterile cotton.
(5) Hydrogen peroxid.
(6) Attic probe.
(7) Ring curet.
(8) Tongue depressor.
(9) Nasal speculum.
(10) Pair of ear forceps.
(11) Pomeroy syringe and pus basin.
(12) Jar of bicarbonate of soda and bowl for irrigating solution.

Bear in mind that this equipment is only for cleansing and inspecting the canal and ear drum, and includes no instruments for testing or treatment. The nasal speculum and tongue depressor are necessary to determine the presence or absence of adenoids or enlarged tonsils, the removal of which is one of paramount importance in certain diseases of the middle ear.

The attic probe is a very fine silver probe about 6 inches long, which tapers to the size of a pin, but has on it a small probe point. It can be bent in any direction and is most useful in examining the middle ear through perforations in the drum, and in judging dis-



Pomeroy ear syringe.



Ring curet.

Attic probe.

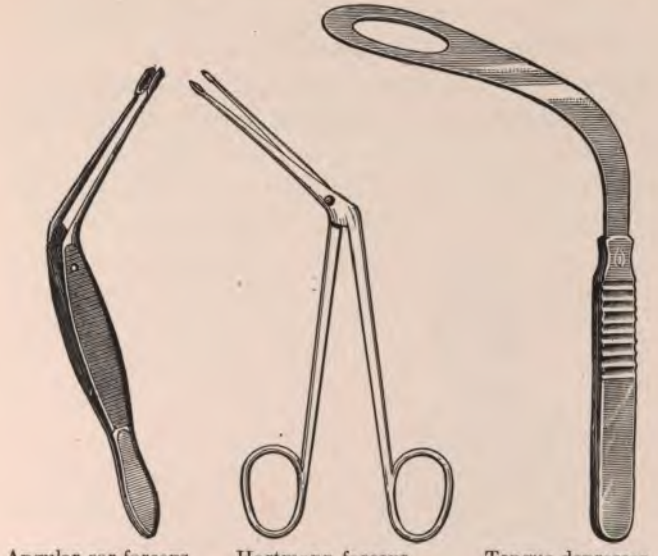
Cotton applicator.

Lucae's bayonet forceps.

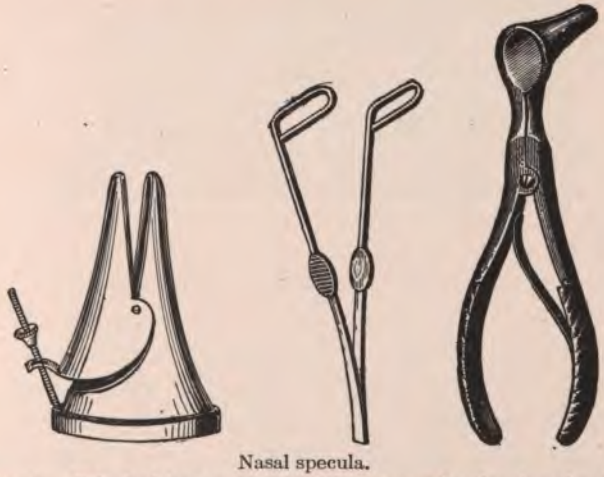
Gruber's ear speculum

Boucheron's ear speculum.

Fig. 43 — Principal instruments used in ear examination.



Angular ear forceps. Hartmann forceps. Tongue depressor.



Nasal specula.

Fig. 44 — Principal instruments used in ear examination (continued).

tance when the canal is so small that both eyes cannot be focused on the same point at once.

When the examining tray or surgeon's instruments are at hand, if the patient is sitting up, the nurse should stand behind; if he be lying down, she should stand at the head of the bed, in either case ready to support the patient's head. A towel should be placed over the

Fig 45 —Position of patient and nurse for an ear examination.

patient's shoulders and another about his head. If there is no bracket for the light, it should be held by the nurse behind the patient's head on the side corresponding to the surgeon's mirror (Fig. 45); for example, if he wears the mirror over his left eye, the light should be behind and on the right side of the patient's head, and vice versâ.

Tests for Hearing

Knowledge of the tests for hearing is of little importance to the general nurse, but an understanding of the tests commonly employed will be helpful to the office nurse, who has to record them.

Hearing tests have two objects: (1) To find out the acuteness of hearing or degree of deafness; (2) if deafness exists, to localize the diseased conditions which cause it.

The acuity of hearing is commonly tested by the voice or whisper and by the watch or acoumeter. The acoumeter gives a loud tick, and is heard by a normal ear something over 40 feet. Watches vary and their ticks are not the same, so one has to judge by experience the distance a particular watch is heard by the normal ear, and use that distance as a denominator. Say a watch is normally heard at 36 inches, then normal hearing would be represented by $\frac{36}{36}$. If the patient hears the same watch at 18 inches, his hearing will be recorded as $\frac{18}{36}$.

The whisper test is made by repeating words and numbers with as much force as possible after a normal expiration with the air remaining in the lungs. By this method the same observer will whisper with the same force on different occasions, and then a comparative test is valuable.

High and Low Tones.—It is necessary in testing the hearing to find the tone limits; that is, the lowest and the highest tone the patient can hear, and at the same time to note whether he can hear the intermediate tones. This is done by means of tuning-forks

(Fig. 46), which range from the normal low-tone limit of 16 vibrations per second to 4096 vibrations. Above this pipes are used, and for the highest tones the Galton whistle, which reaches something over 50,000 vibrations, though 30,000 vibrations per second is about as high as the human ear is able to appreciate sound. Musical notes never reach above 5000 vibrations (piccolo); above this are classed sounds like the squeaking of mice and the chirping of crickets.

Localization tests are to find out whether the disease is in the *sound-conducting* or *sound-perceiving* appara-

Fig 46.—Instruments for testing hearing.

tus, and are conducted usually with a 256-vibration fork.

The most usual localization tests are:

(1) **Schwabach's Test.**—"When there is obstruction in the sound-conducting apparatus (disease of the external or middle ear), a vibrating tuning-fork held against the skull is heard longer than under normal conditions. Schwabach also noticed that the period of perception was shortened in disease of the auditory nerve."

(2) **Rinne's Test.**—A tuning-fork held just outside the opening of the external canal is heard longer than when its stem is held against the normal mastoid

process. Air conduction, therefore, is superior to bone conduction in normal individuals. When this is the case, Rinne's test may be described as *positive.* When it is heard longer on contact over the mastoid than through the air at the meatus, it is not normal and Rinne is *negative.*

(3) **Weber's Test.**—When a strongly sounding tuning-fork is held against the forehead or on the top of the head in the middle line, and when one ear is firmly closed by the tip of the finger, the sound seems reinforced or strengthened and is referred to the closed side. The result of Weber's test may be described as, Weber referred to left or right ear.

In *typic middle-ear diseases or any impairment of the sound-conducting apparatus* Schwabach's test would show bone conduction increased, Rinne's would be negative (bone conduction better than air conduction) and Weber would be referred to the poorer side.

In *typic nerve deafness or disease of the sound-perceiving apparatus* the bone conduction would be diminished, Rinne positive, and Weber referred to the least affected side. There would be a failure to hear high tones, whereas in middle-ear disease there is a deafness for low tones.

Caloric Reaction Test.—When the internal ear is intact and functionating, nystagmus (a jerky movement of the eyes) can be produced by directing a gentle stream of hot or cold water through the canal against the drum-membrane; and if this irrigation is kept up for five minutes or even less, dizziness, nausea, and occasionally vomiting will be produced. When the drum-membrane is perforated, less time is needed to produce the effect.

The movement of the eyes on using cold water is more marked when they are directed away from the ear irrigated, and the movement itself is in this direction. The reverse is true when hot water is used.

When the above symptoms do not appear after irrigating for more than five minutes, the labyrinth may be considered functionless.

CHAPTER XIX

DISEASES OF THE AURICLE AND EXTERNAL AUDITORY CANAL

Eczema.—The kind that most frequently requires the care of a nurse is the *acute* form which occurs in children, and is usually associated with a discharge from the middle ear. This discharge, from neglect and want of proper treatment, causes an excoriation and infection of the skin of the canal and sometimes of the whole scalp. In young babies and in weakly strumous children another form sometimes occurs in the fold behind the ear and spreads to the skin over the mastoid and superior surface of the auricle when there is no middle-ear discharge.

Treatment consists of particular attention to the middle-ear discharge, when it is present, as described under chronic purulent middle-ear disease (O. M. P. C.), and the local application of zinc oxid ointment after the careful removal of the crusts and cleansing of the affected area. After the first general cleansing, watery solutions or hydrogen peroxid should not be used on the affected surface, but it should be kept protected and well coated with ointment and covered with sterile gauze. If the scalp is involved, it should be shaved, the crusts soaked off with oil, and a mixture of zinc oxid ointment and ammoniated mercurial ointment applied. Bland ointments, such as zinc oxid, are better than those with

salicylic acid and other irritating substances in them, except in rare instances. Proper constitutional treatment, diet, and hygienic surroundings are most important in these cases.

The **chronic dry eczema** of the external auditory canal causes intense itching and fills the canal with epithelial scales (dandruff) and plugs.

Treatment is to remove scales and plugs and keep the canal packed with pledgets of cotton or gauze saturated with ointment or oil. If the plugs cannot be removed easily, hydrogen peroxid may be used to soften and dissolve them; they should then be syringed with a solution of bicarbonate of soda and water. After this is done the canal must be carefully dried and filled with gauze saturated with zinc oxid ointment or equal parts of zinc oxid and white precipitate ointment.

Solutions of bichlorid of mercury should not be used, nor should boric acid or iodoform, as they sometimes cause dermatitis. Salicylic acid with zinc ointment for the first dressings is often found useful in these cases in removing crusts.

Iodoform dermatitis occasionally occurs after operations on the ear, owing to the use of iodoform dressings. At times this may give rise to alarming symptoms, particularly in children. Treatment consists in constant application of cotton or gauze soaked in ice-cold water, to which a teaspoonful of the following mixture has been added:

Aluminii sulphat.....	8 gm.
Liquor plumbi subacetatis	4 cc.
Aquæ.....	100 cc.—M.

Sig.—1 dram to 6 ounces of ice-water; apply externally.

Perichondritis (inflammation of the cartilage of the ear) may be treated in its first stage for the first twelve or twenty-four hours similarly. It requires the most constant attention, however, and the nurse should report the slightest advancement of the inflammation to the surgeon, in order that more radical treatment may be instituted before it is too late. The ugliest deformity of the ear is the shriveled auricle or "pugilist's" ear, resulting from a severe perichondritis.

Cerumen (ear wax) and **epithelial plugs (dandruff)** should be softened and syringed out in the manner described, and under no circumstances should the nurse attempt their removal with any kind of instrument.

Cerumen drops, composed of bicarbonate of soda, gr. xxv; glycerin, ʒj; aqua, ℥j, are often prescribed to be instilled into the ear for several hours or even days before attempting the removal of the plug by syringing, but in the majority of cases such plugs may be removed without this delay by instilling warm hydrogen peroxid, allowing it to remain five or ten minutes with the patient lying down, and then syringing with warm solution of bicarbonate of soda (2 drams to 1 quart of water), using a Pomeroy syringe in the manner described on p. 178.

Otomycosis, a disease which fills the canal like an epithelial plug, is due to a fungous growth called aspergillus. It may be removed by syringing, and should then be treated by instillations of antiseptic solutions to kill the growth.

Frost-bite.—The margin of the helix or rim of the auricle is the part first affected. The ear becomes yellowish white and, if badly frozen, may become brittle.

The most important thing to remember is to exclude the patient from a warm room until the circulation of the ear is restored. Apply gentle friction with snow or cracked ice at first, then bathe the ear with ice-water, and keep it cool.

Foreign bodies in the canal can in nearly every case be removed by syringing, and no one but an experienced otologist should ever attempt their removal in any other way, no matter how easy it may seem to do so with a pair of forceps or a hook. The attempt to remove them with instruments often results in their being either pushed through the drum or in producing so much swelling of the canal that an anesthetic and incision behind the ear is necessitated.

Peas, beans, and bodies that are liable to swell if kept moistened, should be syringed with alcohol if the first attempt or two with water fails to remove them. This is important, as the alcohol takes up the water and prevents the swelling.

Many other ways are advised, but the nurse should not assume the responsibility of attempting them, but should call in an otologist.

Furuncles of the Canal.—Boils occur in the external auditory canal frequently as a result of infection from a purulent middle ear. Often, where there is no apparent cause, the infection may be traced to the use of ear spoons, hairpins, or other implements which have caused slight abrasions. Anemic and diabetic subjects are frequent sufferers.

The canal becomes swollen and very painful, and is usually occluded by débris and swelling.

Treatment consists in first cleansing the canal with

hydrogen peroxid and warm soda solution, irrigating it with an antiseptic solution, and then in making a free incision (usually under gas or other anesthesia) through the swelling. The incision should be kept open by packing the canal with plain sterilized absorbent gauze moistened in 1 per cent. solution of carbolic acid. A large gauze dressing should be applied to the whole ear and kept wet with *weak* carbolic solution (1 per cent.), and the dressing should be changed frequently. The recurrence of these boils is often avoided by swabbing out the interior of the canal with 95 per cent. carbolic acid, followed quickly by an application of alcohol.

Diffuse inflammation often spreads from the canal to the external ear, and sometimes can be treated without incision by first cleansing away all the débris and using a hot antiseptic wet dressing. Packing the canal with pledgets soaked in 50 per cent. boroglycerid is often used, as are applications of antiphlogistin. Hot-water bags may be used to relieve pain, but heat as it was formerly used, in poultices of flaxseed, etc., is no longer used to any extent in these antiseptic and aseptic times.

CHAPTER XX

DISEASES OF THE MIDDLE EAR

Acute middle-ear catarrh (O. M. C. A.[1]) is an acute catarrhal affection of the middle ear in which the mucous lining of the cavity becomes inflamed. The drum is somewhat reddened; sometimes bulging, but may be retracted, dependent on whether the middle-ear cavity itself is more or less filled with mucous or serous fluid. It is accompanied by a feeling of fulness or stuffiness in the ear, sometimes amounting to pain, and is caused by congestion and swelling of the Eustachian tube and its lining membrane, as well as that of the tympanum. This condition is usually associated with cold in the head, inflamed nasopharynx, or adenoids and enlarged tonsils, and occurs most frequently in children.

Treatment is directed toward the swollen nasopharynx by removing adenoids and enlarged tonsils if present. Gentle inflation of the middle ear with a Eustachian catheter is practised in cases where there is retraction of the drum with little fluid present. If there is redness and bulging of the drum-membrane, showing the presence of fluid behind it, an incision should be made and the fluid evacuated.

Hot oil, laudanum, and other well-known "grandmother's remedies" should not be employed, for, be-

[1] Otitis media catarrhalis acuta.

sides being useless, they are dirty, sticky, and difficult to remove.

Where something must be done to conciliate the patient before the surgeon's arrival, a few drops of warm salt and water or a warm solution of adrenalin chlorid (1: 1000) may be instilled into the canal, and a hot-water bag applied, with some relief and no damage to the ear.

Acute purulent otitis (O. M. P. A.[1]) is a step further advanced in middle-ear inflammation than the O. M. C. A., and develops where that condition has become infected with a pus-forming germ, giving rise to an abscess in the middle ear and causing the earaches so frequently met with. These earaches are predisposed by adenoids and enlarged tonsils, and usually follow head colds or some disease which has caused an inflammation of the nasopharynx. The inflammation extends up the Eustachian tube to the middle ear and causes an exudate in that cavity, which becomes infected by some pus-forming germ from the nose or throat. Violent blowing of the nose, forcing mucus up through the tube, the improper use of nasal douches, and sniffing of water up the nose should be avoided, on account of the danger of producing such an infection.

No earache should be treated as a trivial matter, nor should the discharge be neglected if it continues after the earache has ceased, owing to the ease with which serious complications develop. Mastoid antrum tenderness is present in nearly every case of acute earache and the possibility of extension to the mastoid cells is always imminent. As soon as the diagnosis of O. M. P. A. is made, the patient should be put to bed and preparations

[1] Otitis media purulenta acuta.

made for *myringotomy* (incision in the drum), which is usually performed now instead of a *paracentesis* (puncturing of the drum), which was formerly the treatment in these cases.

Occasionally after spontaneous rupture of the drum, myringotomy will not be necessary, but this is very rarely the case, because the rupture is usually insufficient for drainage, both on account of its size and its location in the drum. In practically every case a general anesthetic will be required, and nitrous oxid gas is the one usually employed. The nurse should have ready at the bed-

Fig. 47.—Myringotomy tray.

side sterile towels, cotton, and cotton applicators, or sterile toothpick swabs (preferably both), a few glass slides for smears, hydrogen peroxid, alcohol, a Pomeroy ear syringe and pus basin, and an irrigating solution of boric acid or 1:5000 bichlorid of mercury for cleansing the canal (Fig. 47).

If the patient is at a hospital the instruments needed, except the knife, will be found on the examining tray and should be freshly sterilized. The knife (myringo-

tome) should be placed in 95 per cent. alcohol and the blade should never be wrapped in cotton, but should be treated with the same care as a cataract knife. If the operation is to be at the patient's house, the surgeon may be relied upon to bring his own instruments.

Immediately after the operation the canal should be cleansed by syringing with moderate force to prevent the blood-clot from blocking the incision. Occasionally, particularly in children, a moist gauze drain is introduced into the canal down to the drum, and the discharge is absorbed into a loose dressing over the auricle. The usual treatment, however, is irrigation of the canal every two or three hours, according to the amount of discharge, with a weak bichlorid solution (1:5000 or 1:10,000), boric acid (saturated), or normal salt solution. In the interval, sterile cotton should be kept in the meatus to prevent the discharge from running over the auricle and excoriating the skin. This should be changed frequently to prevent it from acting as a plug. Children should wear tight-fitting caps of thin material (Fig. 48) to prevent them from removing the cotton and spreading the discharge with their fingers.

Fig. 48.—Babies' ear-cap.

In acute cases boric acid or sterile salt solution is preferable to bichlorid solution for irrigation, as it is less liable to cause sloughing of the edges of the incision, which might produce a permanent perforation in the drum. Boric acid crystals will be found more conve-

nient than the powder for making the solution, as they are more soluble, and do not, like the powder, float on the surface.

It is also important that the irrigation be at a temperature grateful to the patient (106° to 110° F.), as the ear is sometimes so sensitive that a cold solution will

Fig. 49.—Irrigating an ear.

cause it to ache for hours and a sleepless night will follow.

The best apparatus for irrigating the ear at the bedside is either a fountain syringe or an irrigator. This should be hung at a height of 2 or 3 feet above the level of the patient's head. The flow is steady and gentle, can be easily controlled, and has not the painful features of bulb syringes, which squirt large air bubbles into

the canal, and cause loud explosions, which are most disagreeable to the patient (Fig. 49).

An old syringe that has been used for other purposes should never be employed when a new one can be procured. Both the tube with the small tip and the bag should be thoroughly cleaned and boiled before using.

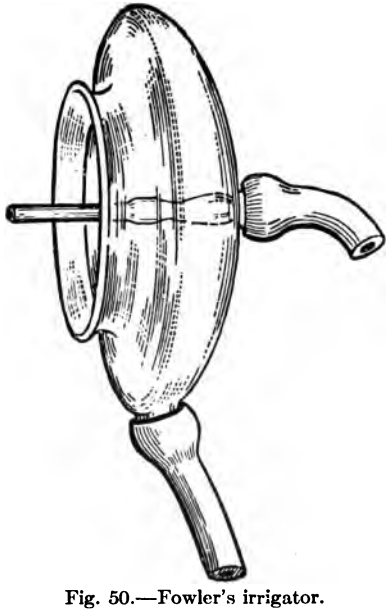


Fig. 50.—Fowler's irrigator.

After each irrigation the apparatus should be taken down and dried, wrapped in a clean towel, and set aside for the next irrigation.

Fowler's "bell glass irrigator" (Fig. 50), which not only cleanses by the flow of water through it, but has a suction effect as well, and keeps the solution from wetting the patient, has recently come into favor with many

surgeons as a useful apparatus for use with the irrigator. Lucae's glass return-flow irrigating tip (Fig. 51) is another satisfactory device which has been in use for years. They are made in different sizes and can be obtained at almost any pharmacy.

When the ordinary tip is used it should be long and narrow, considerably smaller than the meatus, so as to allow ample room for the return flow. When the tip is placed in position, barely within the meatus, which should be straightened in the same manner as when the ear is syringed, the stream should be directed, not against

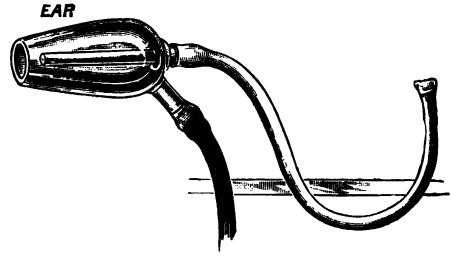


Fig. 51.—Lucae's glass siphon douche.

the drum, but against the side of the canal far back. If the discharge is very thick and tenacious the irrigator may be raised. In certain cases some surgeons direct the nurse to fill the canal with warm hydrogen peroxid, allowing it to remain for a few minutes before irrigating. Others have considered this a dangerous practice, claiming that the effervescing of the peroxid might carry the discharge from the middle ear into the antrum. Those who make use of it contend that it has been demonstrated that in every case of O. M. P. A. of a few days' duration pus has already invaded the antrum, and that

from its relation to the aditus and middle ear it could not well be otherwise. As the discharge diminishes the irrigations are made at longer intervals, being discontinued when the discharge has entirely ceased.

Ice-bags and ice-coils should not be applied to the mastoid except by special order of the surgeon. Cold local applications diminish the tenderness and relieve the pain without stopping the progress of the disease and mask the symptoms to a dangerous degree. Morphin, codein, acetanilid, or phenacetin should not be given, for the same reason. In nervous, restless patients sodium bromid and trional, drugs which induce sleep without so much interference with temperature or local condition, may be used for the first night or two. The temperature should be taken by the rectum, every three hours, night and day, and a careful watch kept for any sign of chill or sudden rise of temperature. The bowels should be kept open and the patient restricted to a liquid diet until all untoward symptoms pointing toward mastoid involvement have subsided. Careful watch should be kept night and day, and should any one of the following symptoms arise the surgeon in charge must be notified at once: chill, sudden rise of temperature, intense headache or pain, dizziness, or vomiting, nystagmus, continued drowsiness or stupor, stiffness of neck or retraction of head, delirium, or coma.

Chronic purulent otitis media (O. M. P. C.[1]) follows O. M. P. A. frequently as a result of its neglect or improper treatment. It often occurs after scarlet fever, measles, and other acute infectious diseases, where the ears have been neglected in the general treatment of the illness,

[1] Otitis media purulenta chronica.

the child being too sick to call attention to the acute otitis, which is allowed to become chronic through lack of treatment. To prevent this in such cases aural examinations should be made every few days. The foul discharge in these cases can be markedly diminished and rendered free from odor by the following treatment:

Have the patient lie down with the affected ear up, fill the ear with warm hydrogen peroxid and work it well down to the middle ear by now and then drawing the auricle upward and backward, wipe away the foam; put in fresh solution and keep the treatment up for five minutes; then syringe the ear clean with boric acid solution or 1:5000 bichlorid, and after drying the canal drop in a half teaspoonful of 80 per cent. alcohol, and fill the meatus with cotton, to be changed frequently. The alcohol will in most cases smart considerably the first few times it is used, but the ear soon becomes accustomed to its use. If there is any dermatitis of the canal or auricle, use boric acid solution instead of bichlorid, and apply zinc oxid ointment to the irritated area. For the first few days this procedure may have to be followed *every three hours*, but when the discharge diminishes it can be done less frequently. It is very necessary when adenoids and enlarged tonsils are present to have them removed, as they are most frequently the exciting cause of the disease.

Cotton should be kept in the ears and changed frequently to prevent the discharge from flowing over the auricle and cheek and producing a dermatitis which not infrequently involves the whole side of the face and scalp. In the treatment of children

the tight-fitting caps before spoken of will be found useful.

When the above treatment fails after a fair trial, an ossiculectomy or the radical operation, depending on the extent of the disease, should be considered to effect a cure.

Chronic catarrhal otitis (O. M. C. C.[1]), or dry catarrh of the middle ear, is frequently the cause of deafness, but persons afflicted with the disease rarely need the care of a trained nurse in the treatment of it.

From having to record tests of hearing before and after treatment the office nurse will appreciate the benefit to be derived from treatment commenced early in the course of the disease and the hopelessness of benefiting those of long standing.

The removal of adenoids and enlarged tonsils when they exist in cases of beginning deafness will often promote the return of normal hearing. In such cases occasional inflation of the middle ear with the Eustachian catheter and proper care of the nasopharynx will prevent the return of the deafness.

Preparation for Operation on the Mastoid

The "simple mastoid" operation does not extend beyond the *mastoid* process of the temporal bone. It consists in the removal of all the cellular structure of the mastoid process *without invasion of the middle ear* or external auditory canal.

The commonly called "radical" is performed only when the middle ear is so diseased that its drum and ossicles have to be removed. The posterior bony canal

[1] Otitis media catarrhalis chronica.

wall is then cut down and the cavity of the middle ear is cleaned out and joined to that of the mastoid antrum, making one large cavity. The remaining cells of the mastoid process may or may not be removed, depending on their condition. In either case, a new meatus has to be made by cutting the auricle. The walls of the canal are folded back to prevent its atresia (closing up) and to increase the space for subsequent dressings. In

Fig. 52.—Area shaved on a woman. The hair is braided tightly to the opposite side of the head and a lock of hair is left in front of the ear.

Fig. 53.—Area shaved for mastoid operation.

many cases the incision over the mastoid bone can be sewed up and the cavity dressed through the new meatus.

In preparation of the patient for a simple mastoid or radical operation in private practice, particularly in women, the nurse should inquire of the attending surgeon exactly how much hair he wishes her to remove with the razor and thereby avoid a responsibility which

is sometimes to the patient the greatest in connection with the operation.

She should also inquire whether or not the patient is to have a shampoo. If this is not contraindicated, it adds greatly to the comfort of the patient in the weeks following the operation when the head is bandaged. Usually a shaved area extending 2 inches from the meatus in the required direction is sufficient, and most women appreciate the saving of a large lock of hair just in front of and above the auricle. This can be combed forward and upward and that part next the field of operation held down with collodion (Fig. 52).

Before preparing the skin the canal should be thoroughly cleansed, first with hydrogen peroxid, then with bichlorid solution (1:5000), and filled with gauze moistened with the solution. The auricle and field of operation, the cheek and the neck, should next be thoroughly scrubbed with green soap and water, alcohol and ether, and washed off with 1:5000 bichlorid solution. A large moist dressing of 1:8000 bichlorid solution should then be applied, care being taken that the crevices in the auricle are well filled with small strips of gauze, and that the dressing extends well forward on the cheek and down the side of the neck. Great care in the preparation of the auricle itself is particularly necessary before the "radical" operation, because of the incision made in the concha for the new meatus.

It is not unusual to see a patient come into the operating room with a dressing which barely covers the auricle, leaving part of the field of operation entirely exposed. The dressing should come well down on the neck, even if it be somewhat cumbersome and difficult to keep in position.

When skin-grafting is to be employed in a "radical," the *left* thigh (without reference to the ear that is to be operated on) should be chosen, and its anterior and inner aspect prepared; because experience has shown that it is easier to cut the skin from above downward than it is from below upward. If the surgeon cuts grafts with his left hand, the right thigh should be prepared.

For preparation of an operating room, refer to Chapter I.

After the patient has been anesthetized, the bandage should be cut and the dressing removed without the field

Fig. 54.—Arrangement of towels around mastoid region before operation.

of operation being touched by the nurse whose hands are not sterile. The patient's body should be covered with a sterile sheet, and the head, face, and neck with towels properly arranged and pinned in place around the mastoid by the nurse whose hands are sterile. Folded iodoform gauze strips ½ inch wide should be close at hand from the beginning of the operation in case they are needed for a rent in the sinus or dura.

Skin-grafting.—When skin-grafting is necessary, a

separate table with the instruments and solutions on it should be made ready and covered with a sterile cover, so that after the cavity has been prepared the grafts may be cut and placed with clean instruments and fresh solutions, without fear of contamination from the soiled table and instruments.

Together with the razor and special grafting instruments, the nurse should have on the table three glass slides; a pair of sharp-pointed scissors; a pair of heavier scissors; one small spoon curet; one medium-sized spoon curet; two pairs of bayonet-shaped forceps; a number of applicators; sterile cotton, toothpick swabs, a bowl of warm salt solution, gauze sponges; a tube of ½-inch plain gauze packing to be used for pledgets. Some surgeons use cotton pledgets with aristol on them to hold the grafts in place, so it is well for the nurse to inquire what the surgeon is in the habit of using. Often little attention is paid to the abrasion on the thigh, and frequently patients complain of the pain it gives them. A dressing of silver leaf applied thickly and bandaged firmly to prevent any oozing of blood under it will be found most satisfactory. If properly applied the dressing need not be removed for ten days, when the surface will be healed.

Emergencies that May Arise.—One of the most frequent complications that arise in mastoid surgery is hemorrhage from the lateral sinus, the large vein lying in the covering of the brain, due to its accidental or intentional opening by the surgeon. This can be controlled immediately if the nurse has right before her the folded iodoform gauze strips already spoken of. These must be at hand from the very beginning of the opera-

tion, as the sinus is sometimes injured at the first stroke of the chisel.

When the sinus is found unexpectedly clotted and it is necessary to tie off and take out the internal jugular vein, its continuation in the neck, the nurse has only to supply a sand-bag or some folded towels to put under the patient's shoulders. A rectal tube and plenty of hot sterile salt solution should be ready in case it is needed for treatment of any shock that may arise from the operation. If intravenous infusion is necessary it is the part of the surgeon to attend to it, and the nurse has only to supply the salt solution. When the jugular vein is to be excised there is at first a hasty preparation of the skin of the neck with soap, water, alcohol, and bichlorid, or some antiseptic solution, but nothing outside of the things enumerated under Preparation of an Operating Room will be needed.

When a brain abscess is encountered the surgeon may require other instruments, but the nurse cannot be expected to have them ready unless notified in time. If she has the things before mentioned she will be prepared for any emergency.

Other Operations

Myringotomy.—A general anesthetic, preferably nitrous oxid gas, should be administered for every paracentesis or myringotomy unless it is contraindicated by the condition of the patient. An exception may be made to this rule in the case of very young babies, which can be swathed and held still by an assistant. Preparation for this operation is described under treatment for O. M. P. A. (p. 194).

Ossiculectomy is the operation for removing the ossicles from the middle ear, that is, the malleus and incus, the stapes being left in its place. This is often done under cocain anesthesia, but is probably done with greater satisfaction to the patient under a general anesthetic. The preparation for this operation consists of cleansing the ear thoroughly with hydrogen peroxid and 1:5000 bichlorid of mercury solution, and packing the canal and crevices of the auricle with gauze saturated with 1:8000 bichlorid of mercury solution, which should remain in the ear until the time for the operation.

The usual hand solutions should be gotten ready and a table prepared having on it a full set of ear specula, scissors, applicators, toothpick swabs, gauze packing, adrenalin, and an ear dressing. The surgeon may be expected to select the ossiculectomy instruments, and after he has removed the ossicles, a sterile ear syringe (Pomeroy's) should be ready for syringing out the blood before packing the canal with iodoform or plain gauze.

Incisions of Furuncles in the Aural Canal.—A general anesthetic is usually employed, and the patient should be prepared accordingly. The auricle is usually too sensitive to admit of much cleansing before the patient is anesthetized, and it need only be wiped off and protected with gauze saturated in an antiseptic solution before this is done. The instruments needed are a set of ear specula, furuncle knife, bayonet forceps, small spoon curet, scissors, probe, director, and applicators; the solutions: alcohol, hydrogen peroxid, carbolic acid (95 per cent.), and a bowl of 1 per cent. carbolic acid solution, unless some other antiseptic solution is preferred by the surgeon. A Pomeroy syringe and pus basin,

sterile towels, a tube of plain gauze packing, and an ear dressing will complete the list of things necessary. (See Treatment of Furuncles, p. 190.)

Dressing and Bandaging.—The technic of dressing "mastoids" and "radicals" varies greatly with different surgeons, but in the main they use the same instruments and make use of the same dressings and solutions.

Some surgeons dress their cases without touching the wound or any of the dressings with their fingers. They hold the auricle between their fingers with thin squares of cotton an inch or more in size moistened in 1:5000 bichlorid of mercury solution, and with smaller pieces held in forceps wipe out the wound with whatever solution they see fit, and use sterile toothpick swabs to avoid twisting cotton on applicators with their unsterile fingers. The rest of the dressing, except the outside cotton and bandage, is applied with the same precaution.

Other surgeons use gloves; handle the packing and gauze freely, and twist cotton on applicators without fear of infection. Others do not use the gloves, but follow this last technic, considering that they have sterilized their hands by immersion in an antiseptic solution. This is the most unsafe method of the three, as most men are in too great a hurry to properly sterilize their hands.

A dressing tray for mastoid and radical cases should hold the following instruments in a small tray carefully protected with a sterile cover of either cloth, metal, or glass: Bayonet-shaped or straight forceps; Hartmann forceps, scissors, straight and curved, full set of ear specula; applicators, silver probe, attic probe, ring curet,

two spoon curets, medium and small. A head-mirror and a pair of bandage scissors are also necessary, but, of course, these should not be placed on the sterile tray (Fig. 55).

There should be one dish containing a solution of 1:40 carbolic acid to receive the soiled instruments and, in addition, a finger-bowl filled with whatever solution the surgeon desires—bichlorid, boric acid, carbolic, or salt solution. In a separate part of the tray away

Fig. 55.—Dressing-tray for mastoid and radical cases.

from the sterile instruments a silver nitrate stick and the small solution bottles containing nitrate of silver solution (50 per cent.), sterile cocain (10 per cent.), collodion, balsam of Peru, and any other solutions especially required, should be placed. Larger bottles of peroxid and alcohol, with two medicine-glasses in which to pour them, should also be supplied.

The gauze packing, both iodoform and plain, and balsam of Peru, should be of the softest, most absorbent

gauze with infolded edges ½ inch wide, kept in tubes 6 inches long. Larger tubes than these are unnecessary for most dressings, and gauze left in a tube should not be used at a future time without being resterilized. This is important, as old tubes of gauze, left with their cotton stoppers pushed down in them and their necks entirely exposed to contamination, is a most common and flag-

Fig. 56.—Method of applying bandage to mastoid dressing.

rant example of faulty technic. Two jars of absorbent cotton wipes, moistened in 1:5000 bichlorid, are necessary for those who dress their cases without touching the wound or dressings with their fingers; one of large, 1 inch or more square, for holding the auricle, and the other of those ½ inch square, to be used with the forceps for wiping the wound. Toothpick swabs and sterile cotton or cotton balls should be kept in small packages

rather than in jars, as they are then less liable to contamination. The dressings should be in individual packages, wrapped in muslin and sterilized. Each package should contain the usual thickness of absorbent cotton 6 inches square; two or more large handkerchiefs of shaken gauze, and a semilunar patch of folded gauze

Fig. 57.—Finished mastoid dressing.

to place behind the auricle over the wound. The last is not necessary, but is often very convenient.

In dressing a mastoid, particular attention should be paid to the cleansing of the canal at each dressing, and this should be kept well filled with plain gauze packing, both to absorb the secretion and to prevent its closure. Particular attention also should be paid to the skin around the wound, which becomes easily irritated. This should be kept covered with zinc oxid ointment.

In bandaging, the ear should always be bandaged backward against the head. When applied in the opposite direction the tendency is to carry the auricle forward and close the meatus, and in children, occasionally, to fold the auricle on itself and cause a lop ear (Figs. 56 and 57).

Fig. 58.—Black silk ear patch.

To recapitulate the articles needed for a dressing tray:

(1) The instruments named, which are not many and take up very little space.

(2) Head-mirror and bandage scissors—the last the nurse should have in her belt.

(3) Dish of 1:40 carbolic acid solution for soiled instruments.

(4) Two jars of bichlorid wipes—large and small.

(5) Package of sterile towels.

(6) Bowl of solution (bichlorid, 1:5000).

(7) Peroxid, alcohol, and two medicine-glasses.

(8) Silver nitrate stick and jar of zinc oxid ointment.

(9) Bottles of silver nitrate (50 per cent.) collodion (with cork in brush), 10 per cent. cocain, and any other solution especially required.

Fig. 59.—Cotton and collodion dressing.

(10) 6-inch tubes of folded gauze—iodoform, plain, and balsam of Peru.

(11) Small package of toothpick swabs and cotton for applicators.

(12) Individual dressings and bandages.

CHAPTER XXI

DISEASES OF THE INTERNAL EAR

INTERNAL ear affections may be classed as *suppurative* and *non-suppurative.*

Suppurative labyrinthitis may be acute or chronic, in either case it is usually caused by extension of suppurative disease from the middle ear. The panotitis, which frequently makes deaf mutes of children, is usually associated with scarlet fever, and is due to suppurative involvement of both the middle and internal ear. The acute form sometimes follows operation on the middle ear when the labyrinth has been entered and infected or, in rare instances, it may develop in a case of acute otitis (O. M. P. A.) before myringotomy has been performed, the infection passing through the oval or round window. It may also develop suddenly from an old suppurative condition of the middle ear (O. M. P. C.). The patient first becomes dizzy and nauseated and shows marked nystagmus (a jerky movement of the eyeballs) when looking to the side away from the diseased ear, complains of tinnitus (head noises), of headache, deafness, and later may show signs of meningitis.

At the first appearance of any of the above symptoms the patient should be put to bed and the surgeon notified. Early operation for drainage of the labyrinth is advocated by some surgeons; others consider operative interference unwise, and prefer to rely on the protective bar-

riers erected by nature and the administration of sedatives.

Chronic suppurative labyrinthitis may follow the acute form or gradually develop from an O. M. P. C. of long standing. The hearing is usually entirely lost in the affected ear and the caloric test[1] on that side is negative. Pus discharges either through a fistula into the middle ear or antrum, or through the oval or round window. These cases may continue quiescent for years or they may suddenly give rise to meningitis, brain abscess, or thrombosis of the lateral sinus.

The treatment is the same as that given for O. M. P. C., and when this fails the radical operation, with removal of the semicircular canals and drainage of the cochlea and vestibule, should be considered.

Non-suppurative Labyrinthitis.—Sudden loss of hearing in both ears where no suppuration or apparent disease exists is not uncommon. The cause is usually acute congestion, hemorrhage, or exudate in the labyrinth. The patient, deaf to outside noises, complains of roaring or bell-like tinnitus, dizziness, nausea, and staggering gait. He may lose consciousness suddenly and die. This group of symptoms was called Ménière's disease and the cause was said to be hemorrhage into the labyrinth. It is now known that other causes than hemorrhage produce the same symptoms, among which are acute congestion and the formation of exudate or anything that causes a profound disturbance of the labyrinth. Cerebrospinal meningitis sometimes leaves a case stone deaf without any apparent involvement of the middle ear. Syphilis, either hereditary or acquired,

[1] See p. 185.

is a common cause of this kind of labyrinthitis. Other causes are poisonous doses of drugs that cause congestion of the labyrinth, such as quinin and sodium salicylate, caisson disease, and arteriosclerosis. The treatment is, first of all, rest in bed until the vertigo and nausea have disappeared, then large doses of potassium iodid and pilocarpin sweats are usually given to hasten the absorption of the hemorrhage or exudate.

Chronic labyrinthine deafness, like chronic middle-ear deafness, rarely comes under the care of a trained nurse. It is called "nerve deafness" and practically nothing can be done for the relief of it. (See Test, p. 184.) It is sometimes hereditary and may come on gradually, the labyrinthine capsule becoming more and more involved in a spongification, or the acute symptoms of Ménière's disease may subside, leaving the nerve partially or totally destroyed and the patient correspondingly deaf. The same may be true after suppurative labyrinthitis has healed and ceased to discharge.

The deafness of old age is usually a nerve deafness, in which the hearing for low tones remains good, but that for high tones is lost.

In deaf mutes the labyrinths have usually been destroyed in babyhood by scarlet fever, meningitis, hereditary syphilis, measles, or some other acute infectious disease.

IV. THE NOSE

CHAPTER XXII

ANATOMIC DESCRIPTION OF THE NOSE AND ACCESSORY SINUSES

Externally the nose is divided into—

Root, where the two nasal bones articulate with the frontal bone.

Dorsum, the top surface from the root to the tip, formed by the two nasal bones and lateral cartilages.

Tip, the extremity made up of separate cartilages.

Internally the nose is separated into a right and left nasal cavity by the septum. The anterior opening of each chamber is called the vestibule, around the inner part of which thick hairs grow, called vibrissæ. The posterior openings are called the choanæ or posterior nares.

Each nasal cavity has a floor, which forms the superior surface of the hard and soft palate; a roof, which is formed by the cribriform plate of the ethmoid bone; an inner wall, which is the septum; and an outer wall, which is made up of the turbinated bodies which separate each chamber into three meati by their curvatures.

The turbinated bodies or turbinates are three fragile scroll-like bones covered with mucous membrane, and arranged one above the other with a meatus between,

so that they are called, according to their position, superior, middle, and inferior turbinates.

The inferior, as its name implies, is nearest to the floor of the nose, and is ordinarily the largest. The middle

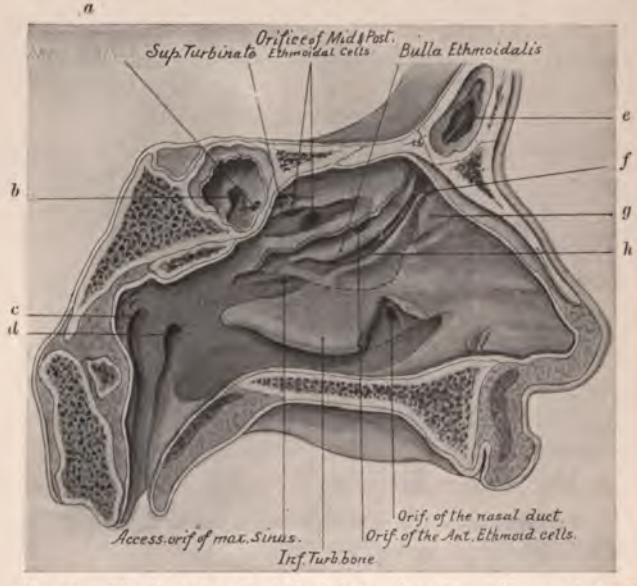


Fig. 60.—The lateral wall of the left nasal cavity. Almost the entire middle turbinated bone has been excised in order to expose the structures and orifices situated beneath it. A piece has been removed from the anterior portion of the inferior turbinated bone. The original borders of the turbinated bones are indicated by dotted lines. The superior turbinated bone is intact. The orifices of the left sphenoidal and frontal sinuses are shown by arrows. *a*, Ostium of sphenoid sinus; *b*, left sphenoid sinus; *c*, fossa of Rosenmüller; *d*, orifice of Eustachian tube; *e*, left frontal sinus; *f*, infundibulum; *g*, attach. middle turbinated bone; *h*, hiatus semilunaris (Schultze and Stewart).

is intermediate and the superior is placed highest in the nostril. Above the superior there may be additional turbinates, but they are of no surgical importance.

The turbinates are arranged in such a manner that the greatest amount of heating and moistening surface is presented to the incoming air in the least possible space. Their function is to warm, moisten, and filter the inspired air before its reception into the lungs.

Beneath the inferior turbinate is the inferior meatus of the nose, the lower boundary of which is on a plane with, and unites in forming, the floor of the nose. Into this meatus empties the tear duct. An inflammation of the inferior turbinate may occlude this duct by pressure or by adhesions to the adjacent mucous membrane, in which case there is an overflow of the lacrimal secretion upon the lower eyelid. The upper third of the septum and upper third of the outer wall of the nasal chamber are supplied by the olfactory nerve, and it is only upon this area of the nose that the sense of smell is perceived. The remaining two-thirds are devoted to the act of respiration.

Beneath the middle turbinate and above the inferior is the middle meatus. Into this there empties the frontal sinus, the anterior ethmoidal cells, and the antrum of Highmore or maxillary sinus, in a common groove.

The frontal sinus drains through a curved groove called the hiatus semilunaris; while the maxillary sinus opens into this meatus through the ostium maxillare. These openings are both under the middle turbinate and are difficult to locate with the probe.

Above the middle turbinate is the superior meatus, into which the posterior ethmoidal cells and the sphenoidal sinus empty. It is exceedingly difficult to probe the sphenoidal sinus through its ostium before the removal of the middle turbinate.

Nasal Septum.—The septum should divide the internal nose into two equal compartments, but, owing to various accidents and faulty development, there are few noses in which this is the case. The septum is made up of the perpendicular plate of the ethmoid, the vomer, and the

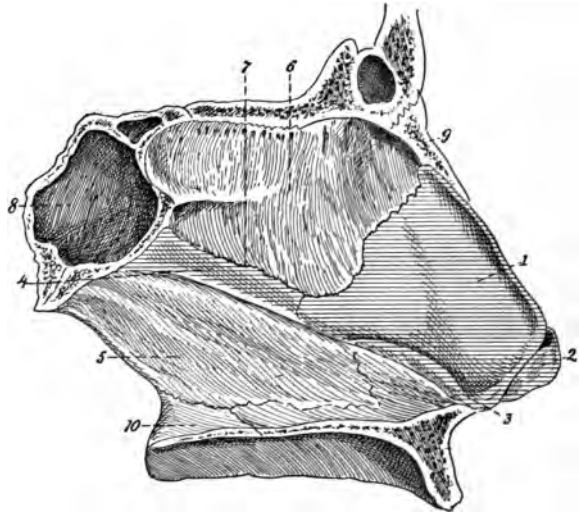


Fig. 61.—Osseous and cartilaginous septum of the nose: 1, Triangular cartilage of the septum; 2, columnar cartilage, cartilage of the aperture; 3, cartilage of Jacobson; 4, supravomerine cartilage, sometimes present; 5, vomer; 6, perpendicular plate of ethmoid; 7, ethmovomerine suture; 8, sphenoidal sinus; 9, nasal bone; 10, palate bone (Arnold).

cartilage of the septum, which is the triangular or quadrilateral cartilage.

The vomer projects from the sphenoid bone behind and extends forward under the cartilage nearly to the anterior extremity, and receives its name from its fancied resemblance to a plough-share. The entire inner surface of the nose is covered with mucous membrane.

That part supplied by the olfactory nerve is known as the Schneiderian membrane.

Functions of the Nose.—It is the organ of smell. It warms, moistens, and filters the air before it enters the lungs. It aids in phonation and in the perception of taste. It gives expression to the face and is a racial characteristic.

The sinuses adjacent to and emptying into the nose are important from their surgical consideration.

The Maxillary Sinus or Antrum of Highmore.—There is one on either side of the nose, situated in the superior maxillary bone, and emptying into the middle meatus. This sinus varies in size from a pea to a walnut and is sometimes absent. The floor of the sinus is frequently on a level with the floor of the nose, but it may be above or below this plane. The floor is formed by the alveolar process of the superior maxilla, and the roof is the floor of the orbit. The inner wall corresponds with the outer wall of the nasal chamber. These are the facings of this cavity of greatest importance from an operative standpoint.

Frontal Sinuses.—They are two in number, situated between the two tables of the frontal bone, and are located internally and superiorly to the upper rim of the orbit of either side. They vary in size from a pea to a chestnut and are sometimes absent on one or both sides. They drain through the hiatus semilunaris into the middle meatus of the nose. They are important surgically because they are frequently infected by bacteria being forced from the nasal chamber into the cavities during the act of blowing the nose. Also, they may be infected by direct extension of the pyogenic organisms existing

in the nose. Probably the most frequent infecting micro-organism is the grip bacillus. By means of the *x*-ray the presence or absence of the sinus may be determined, also its extent, and if it is filled with pus.

Ethmoid Cells.—Between the frontal sinus anteriorly and the sphenoidal sinus posteriorly are situated a mass of bone-cells, which lie above and to the side of the superior meatus. These cells are divided into anterior and posterior cells. The anterior empty into the middle meatus and the posterior into the superior meatus. They are frequently infected by the various bacteria in the nostrils, and it is from these infected cells that most polypi spring when the pyogenic condition has been long neglected.

Sphenoidal Sinus.—There are ordinarily in the sphenoid bone two sinuses divided by a thin lamina of bone, called the septum. They are situated in the body of the sphenoid bone and vary in size from a pea to a pecan nut. They have an outlet known as the ostium, which opens into the superior meatus. This sinus, like the others, is frequently infected, and when filled with serum or pus sufficiently to create pressure, gives pain behind the eyes and a dull headache. Growths, both malignant and benign, originate in this sinus, and when they assume large proportions cause the eye of that side to bulge outward. This condition is known as exophthalmos. To enter this sinus it is necessary first to remove the middle turbinate in order to obtain a perfect view of the operative field.

CHAPTER XXIII

DISEASES OF THE NOSE

Examination of Patient.—For the examination of the nose or throat the patient's head should be on a level

Fig. 62.—Position for examination of the nose.

with or a little below the head of the examiner. The light should be on the right side of the patient on a level with his ear, and may be either gas or electricity

with a proper condenser (Fig. 62). The instruments for examination, as nasal speculum, tongue depressor, etc., should be on a table to the left of the examiner, while the instruments for the operation should be on a table at his right.

For the examination of infants the nurse should wrap the baby completely in a blanket or sheet with the head protruding, as illustrated by Fig. 63. She should hold the baby with its head resting against her left shoulder and her left hand supporting it in front. The most effective method of holding a fractious child is for the nurse to

Fig. 63.—Child swathed in sheet.

take him in her lap, confine his knees and legs between her own, place her arms under his and her hands pressed against each side of his head (see Fig. 6, p. 68). This necessitates a forced extension of his arms and hands outward, and should he endeavor to interfere with the examination, his hands can be kept away by the extension of the nurse's elbows.

Rhinitis.—This may be acute, which is the ordinary cold; chronic hypertrophic; chronic atrophic; purulent; membranous; caseous.

Acute Rhinitis.—The ordinary cold is being treated with more consideration daily, as it precedes so many

of the infectious fevers and other constitutional diseases. Its symptoms are manifest and the diagnosis easily made by all.

Treatment.—Constitutional and local.

The constitutional treatment aims at stimulation and sweating, with free catharsis.

The local treatment aims at removing the infective agent and the prevention of reinfection. To this end, in the later stages, irrigations postnasally with some mild antiseptic solution and the application of a mild astringent may be employed.

Chronic Rhinitis.—Here nasal obstruction exists permanently and a reduction of the swollen membranes is imperative. This may be accomplished by caustics, galvanocautery, or the removal surgically of the offending part.

Atrophic Rhinitis.—This dry state of the mucous membrane of the nose is the most distressing form of rhinitis. The scabs or crusts form in large masses and adhere firmly to the walls and septum. Decomposition takes place in the crusts and produces a most offensive odor. Health is often impaired and the presence of the individual is objectionable to others owing to the odor. The treatment consists in frequent removal of the crusts by irrigations and stimulating the surface with solutions of iodin, argyrol, and ichthyol.

Purulent rhinitis occurs usually in children from infection ordinarily transmitted from other parts of the body by the fingers. Treatment should be directed to keeping the nose clean and to the protection of the eyes.

Membranous Rhinitis.—Here a fibrous exudate is

found on the mucous membrane resembling diphtheria. A culture often, though not always, determines the diagnosis.

Caseous Rhinitis.—Smell is lost and a cheesy material is found in the nasal passages which emits a most disagreeable odor, usually due to a foreign body.

Epistaxis.—Nosebleed may be due to injury, rupture of a blood-vessel, ulceration, adenoids, fevers, or suppressed or vicarious menses. In people over fifty it may denote arterial change, also Bright's disease or heart lesion. Considerable blood may be lost in this way before serious damage occurs. Patients are liable to attach importance to this condition when it is of trivial character. Treatment should be directed to the cause, but when in ignorance of the cause, efforts should be made to stop the existing hemorrhage, except in cases of high arterial tension.

Cold to the nape of the neck; pressure with the thumb or finger against the bleeding side; light packing with pledgets of cotton, which may be soaked in adrenalin, hydrogen peroxid, alumnol, tannic acid solution, or any mild astringent except the iron preparations may be resorted to.

Hay-fever.—Predisposing causes are an inherited neurotic temperament. The exciting causes are plant, animal, and vegetable odors, or possibly the pollen of plants. It usually begins in young adult life and appears with regular periodicity. When the attack occurs in June it is known as June cold or rose cold; hay-fever, when coming on later in the year.

Symptoms.—Stuffy sensation in the nose with copious discharge of clear serum. The eyes are red and the

lids swollen. The roof of the mouth itches and burns; and the patient sneezes continually.

Treatment.—Removal to a high dry place like the White Mountains will often overcome the yearly attacks, but some cases improve more at the seashore or on a sea voyage. Nearly every drug has been tried for the relief of this condition, but none have proved of any great value for any length of time. Internally, benzoate of soda has proved efficacious, also some of the cinchona preparations, as cinchonidia and blennostasin. Locally, solutions of adrenalin, followed by mild antiseptic douches, have given temporary relief. Serum prepared from injections of ragweed was used for a while with good results, but it has now fallen into disfavor.

Lupus. Tuberculosis. Syphilis.—These diseases are treated in accordance with the diagnosis made. Following any of these conditions there may be a destruction of tissue. If the nasal septum is destroyed the dorsum of the nose frequently falls in and causes what is known as "saddleback" nose. If there is any support at all for the tissues, paraffin may be injected subcutaneously to overcome the deformity. The injection should be made only in selected cases and with every precaution exercised to prevent disastrous consequences.

Deviations of the Septum.—This condition may result from injury, faulty development, or congenital malformation. The deviation may involve either bone, cartilage, or both.

Symptoms.—Bad respiration. Dry, scabby secretions over the deflected portion; postnasal catarrh, tinnitus in one or both ears, mouth-breathing, etc.

Treatment.—Surgical. The most approved method

of overcoming this septal deformity is known as the submucous resection. The operation is performed under cocain and adrenalin with the patient sitting up.

The instruments required are nasal speculum, small scalpel, sharp and blunt mucous membrane elevators, a swivel knife, bone-cutting forceps, bivalve speculum, ample number of cotton applicators properly wrapped, and a pair of flat-jawed forceps.

Dressings.—Rubber tissue; plain strips of gauze; vaselin gauze, and Bernay sponges.

Postoperative Care.—Rest in bed with iced cloths placed over the nose. Some sedative should be given to allay the nervousness occasioned by the cocain. Liquid diet and a brisk cathartic. Children under fourteen should not be operated upon, owing to the danger of the nose falling in from lack of support.

Fractures.—By fracture is ordinarily meant the breaking of one or both nasal bones. The bones themselves may be broken or they may have broken away at their articulation with the frontal bone. A fractured nose should be immediately cared for, as the parts can then be placed in almost complete apposition and held there until union takes place.

Hemorrhage is first controlled by packing. After this the inside of the nose is supported by hollow splints or Bernay sponges, while pressure is exerted externally by small roller bandages.

Abscess of the septum or of the dorsum of the nose frequently follows a fracture, particularly if there has been a protrusion of the bone through the nose externally or mucous membrane internally. The nostril should be irrigated with antiseptic solutions to prevent infection.

Sinusitis.—This may be acute or chronic. Sinuses involved are the maxillary, frontal, ethmoidal, and sphenoidal.

Symptoms.—The same symptoms apply in a measure to involvement of all of the sinuses, viz.: headache; local tenderness over the sinus or, in the case of the sphenoid, dull steady pain behind the eyes; chilly sensations; low temperature; peculiar non-resonating tone to voice, perceptible alike to patient and listener; general malaise; loss of appetite, etc.

Treatment.—Palliative and surgical. Palliative treatment consists in spraying the nostril with some slightly astringent solution, such as adrenalin (1 to 8 parts water), followed by copious douching with some hot antiseptic solution with a temperature of 110° F. It is unimportant what antiseptic is employed, provided the water has been rendered alkaline by ʒj of bicarbonate of soda and ʒj of sodium chlorid to 1 pint of water. The astringent shrinks the tissues around the sinus's outlet and the copious flow of hot water tends to draw the pus out of the sinus.

Operative.—Internal and external. The external is ordinarily employed after the internal has failed to accomplish the desired end. The internal operation has for its object the removal of obstructing tissues and establishing free drainage of the sinus. Irrigation of the sinus is then easy of accomplishment and in the majority of cases perfects a cure. The external operation consists in entering the sinus by the nearest route consistent with the anatomy involved, and likewise aims to lessen, as far as possible, subsequent deformity.

V. The Pharynx and Larynx

CHAPTER XXIV

ANATOMIC DESCRIPTION OF THE PHARYNX

The pharynx extends from the posterior limit of the nose to the esophagus, which is to a point opposite the cricoid cartilage, and measures about 5 inches.

It is divided into the nasopharynx, which is that part hidden by the soft palate when looking into the mouth; the oropharynx, which is the part of the throat seen when looking into the mouth with the tongue well depressed; and the laryngopharynx, which is the remaining portion extending to the esophagus.

In the *nasopharynx* are seen the posterior openings of the nares; the openings or entrance into the Eustachian tubes; the fossæ just behind the Eustachian prominences, known as the fossæ of Rosenmüller, and high up in the vault the adenoids, or Luschka's tonsil.

In the *oropharynx* are the faucial tonsils, situated between the anterior and posterior fold on either side of the throat; the posterior pharyngeal wall, where retropharyngeal abscess is most frequently observed; the lingual tonsil, which is at the base of the tongue between the epiglottis and the tongue, and the epiglottis. At the base of the tongue there may be a venous plexus which sometimes dilates to the point of rupture,

causing a hemorrhage, which may be mistaken as coming from the lungs.

The *laryngopharynx* is the narrowest part of the pharynx, and here foreign bodies frequently lodge. Pain is often referred to this location by the patient, although the lesion may be in the larynx proper. The pharyngeal constrictors surround this area and aid in swallowing.

CHAPTER XXV

DISEASES OF THE PHARYNX

Examination of the Pharynx and Larynx.—A head-mirror, postnasal and laryngeal mirrors, tongue depressor, probe, cotton applicator, absorbent cotton (Fig. 64), in addition to source of light, are the essentials for the examination. The patient should be sitting with the light at the level of his ear and to his right.

Fig. 64.—Apparatus for the examination of the pharynx and larynx.

Elongated Uvula.—This may result from an acute or chronic inflammation of the pharynx or it may be congenital. This condition frequently produces cough of a distressing nature and simulates consumption, bronchitis, and asthma. These symptoms may be relieved

by removing the cause. Astringents may prove effective in some instances, but surgical removal is most certain.

Bifid Uvula.—This condition is usually congenital. It ordinarily produces no discomfort, unless the bifurcation extends up to or into the soft palate, when surgical intervention is necessary.

Cleft Palate.—This is congenital also and is merely a continuation of the bifid uvula, and may extend through the hard palate and even through the upper lip, when the condition is known as hare-lip. The operation for cleft palate or hare-lip is a difficult one and is not always attended with success. The younger the patient, the better the hope of success. Rectal alimentation should be employed for four or five days after this operation to insure, as much as possible, proper union of the apposed parts.

PHARYNGITIS

Acute Pharyngitis.—The nasopharynx and the oropharynx with their containing structures are very apt to be involved in inflammation after taking cold, if not immediately, a few days later. Digestive disturbances, rheumatism, and gout are predisposing factors, while cold and grip infection are the exciting causes.

Symptoms.—Dryness of the throat, pain on swallowing, frequent desire to clear the throat, slight itching sensation around the Eustachian tubes, with a fulness in the ears and huskiness of the voice. The glands of the neck may be swollen and tender, and there is usually slight fever, quickening of the pulse, accompanied by chilliness and pain in the back.

Treatment.—Rest in bed, internal medication, sprays,

gargles, postnasal irrigation, medicated steam inhalations, and local astringents by means of applicators.

Chronic pharyngitis follows acute pharyngitis, and is most frequently the result of numerous acute attacks. It is found in rheumatic, gouty, or alcoholic patients. This condition may become granular or dry. The treatment is constitutional, with local stimulation with nitrate of silver, etc.

Pharyngeal Ulcers.—They may be simple, follicular, syphilitic, tubercular, lupoid, or membranous. The diagnosis depends upon the appearance of the ulcer, the history of the case, and the microscopic findings. The treatment varies according to the etiology and pathology of the ulcer. In a general way all ulcers should be kept clean with an antiseptic douche or gargle; the cleansed area dusted with some powder, preferably orthoform, which relieves pain and is also antiseptic. The part involved should be kept as quiet as possible, which in some cases necessitates *rectal alimentation*.

Retropharyngeal Abscess.—This occurs most frequently in children.

Causes.—The result of infection following acute fevers, erysipelas, pharyngeal infections, and tuberculous cervical vertebræ.

Symptoms.—Difficult breathing and swallowing. Restlessness, emaciation, fever, and the inability of infants to nurse. Occasionally this condition is mistaken for adenoids.

Treatment.—Incision and evacuation of the pus. This procedure is dangerous, owing to the possibility of the pus getting into the lungs and resulting in a pneu-

monia. The safest way to open the abscess is to have the child lie on the table with the face downward or held by the nurse with its head downward. However, if the nurse or assistant holding the child is sufficiently quick, the child may be immediately inverted after the surgeon has opened the abscess, in which case the child should be wrapped completely in a sheet or blanket with the head only protruding. The position is then the same as for the examination of children or infants for adenoids. After opening the abscess the patient should be placed in bed with the head lowered. Frequent irrigation of the abscess-cavity is essential to insure proper healing. Iron and other constitutional medication should be given to build up the child.

TONSILLITIS

Acute Tonsillitis.—This condition is ordinarily diagnosed by the patient, owing to the sensations of pain and fulness in the throat and the difficulty in swallowing. Many constitutional diseases are ushered in by acute tonsillitis, as typhoid fever, syphilis, and acute rheumatism.

Predisposing Causes.—Rheumatic diathesis, bad ventilation, digestive disturbances, sewer gas, and low vitality.

Exciting Causes.—Exposure to cold and draughts. Whether acute tonsillitis is infectious is not definitely determined, but in view of its epidemic tendencies it is well to treat it as infectious.

Symptoms.—High fever, occasionally reaching 105° F. Pain in the neck, back, and limbs, chilly sensations up and down the spine, sore throat, difficult swallowing,

headache, and possibly vomiting, due perhaps to the irritation of the pharynx by the enlarged tonsil.

Inspection.—Pharynx, palate, uvula, and tonsils are red and puffy. Upon the tonsils may be seen small white patches which can be easily removed, leaving a reddened surface beneath, but not a raw bleeding one, as in diphtheria. When these patches coalesce they form a membrane resembling a diphtheritic or a Vincent's angina membrane. The cervical glands are swollen and the tonsil is easily palpable from the outside.

Treatment.—Rest in bed, preferably between light blankets, owing to the rheumatic tendency of these cases; good ventilation and proper isolation. Laxatives, salicylates, and iron, depending upon the individual requirements of the case. Sprays, swabs, douches, gargles, and inhalations are all indicated. They are effective proportionately to the way in which they are given. Locally, nitrate of silver, iodin preparations, and guaiacol may be applied directly to the tonsil; while the ice-bag or coil externally is of undoubted value. The diet should be light, preferably liquid.

Chronic tonsillitis results in enlargement of the tonsils. Here the tonsils may be large and protruding or large and buried. They may be also small and protruding or small with deep crypts, and partially concealed by the faucial pillars. The size of the tonsil should not be the controlling factor in the determination of its removal.

Symptoms.—Frequent colds, impaired digestion, foul breath, difficult deglutition, faulty respiration, enlarged cervical glands, and bad health.

Complications.—Peritonsillar abscess; repeated attacks of acute tonsillitis; tuberculous glands, and rheumatism.

Treatment.—Tonsillectomy if conditions warrant it, or, in the small tonsil with shallow crypts, the galvanocautery may be used with more or less success.

Tonsillectomy and Adenectomy.—These two operations are usually performed under the one anesthesia. Formerly it was customary to perform this combined operation on children without anesthesia, but, in addition

Fig. 65.—Instruments for tonsillectomy.

to the unnecessary pain inflicted, it was found that the operation was incomplete.

The positions of the patient for operation are: Prone on the back; on the right side; held upright on the operating table; sitting up in a chair. Each of these has its advocates, and the position is entirely one of election by the operator.

Instruments (Fig. 65).—Each operator prefers his own method of removal, for which different instruments are

necessary. When the patient is upon the back, the Mackenzie tonsillotome and the snare are most frequently used, although the scissors and scalpel are preferred by some operators. When upright on the table or sitting in a chair, the Mathieu tonsillotome and snare are used. The other necessary instruments are tonsil

Fig. 66.—Sitting position of patient for removal of tonsils.

separators, tongue depressor, mouth-gag; sponges on holders; tonsil punch; long flat-bladed forceps; long angular scissors, cutting on the flat; tonsil tenaculum; adenoid forceps, and adenoid curets of two sizes. Some operators prefer an adenotome to either forceps or curet for the removal of adenoids.

Operation.—With the patient upright (Fig. 66), the

mouth-gag is placed well back between the molar teeth on the left side, and the jaws opened as widely as possible. The assistant or nurse then cleanses the throat with a sponge in a holder. The operator liberates the left tonsil from its anterior and posterior folds. This occasions some hemorrhage, and against this bleeding part the nurse holds a sponge until the operator can secure

Fig. 67.—Patient on side in the operation for removing both tonsils.

his tenaculum and snare or his tonsillotome for the next step, which is to engage the tonsil in the snare or tonsillotome and remove it. The nurse again places a sponge on the bleeding surface and creates pressure thereon until the operator begins on the opposite side. By frequent and careful sponging the operative field can be kept fairly clear and no necessity arises for turning the patient on the side to free the pharynx from blood.

When both tonsils are removed it is ordinarily necessary to turn the patient to one side with the head over the table (Fig. 67) to allow free drainage of blood from the pharynx, when he is replaced in the former position with head lowered, so that the blood will not drain into the larynx. After the nurse has again cleared the opera-

Fig. 68.—Position of patient for removal of tonsils.

tive field by sponging, the operator removes the adenoids either with forceps, curet, or adenotome.

Some operators remove the tonsils with the patient reclining (Fig. 68), and have him raised to a sitting posture for removal of the adenoids. The patient should be raised slowly to a sitting posture, as rapid change of posture may weaken the heart's action. All of these various postures are merely the

forms preferred by different individuals. The complete removal of the tonsils and adenoids is the object of all. When the operator prefers the patient in a chair, the anesthetic is given with the patient on a stretcher, and then removed to the chair. This method of operating requires more assistance, and is somewhat longer

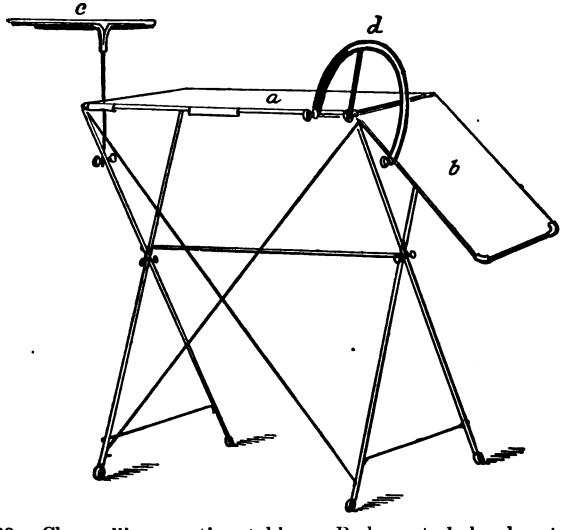


Fig. 69.—Chappell's operating table: *a*, Body rest; *b*, head rest; *c*, instrument tray; *d*, head rest controller.

in accomplishment, although a better opportunity is afforded to determine if the tonsil is entirely removed.

For children the Chappell portable table (Fig. 69) is ideal, as it is sufficiently strong, high, and light to make it desirable both in private and hospital work.

Before the patient is removed from the table a sponge wet with tannic and gallic acid solution is applied to the tonsillar bleeding surface, and the face is slapped with

a towel well soaked with ice-water (Fig. 70). The shock produced tends to stop oozing. Should the

Fig. 70.—Nurses' tray for adenoid and tonsil operation.

hemorrhage continue, hydrogen peroxid may be applied on a sponge or injected forcibly through the nostril to

Fig. 71.—Mikulicz-Stoerk tonsil hemostat.

cover the bleeding area in the nasopharynx. There should always be in readiness a Mikulicz-Stoerk or Hurd's

tonsil hemostat (Figs. 71 and 72), which can be applied when other measures have failed to control the hemorrhage.

Fig. 72.—Hurd's tonsil hemostat.

After-treatment.—The patient is placed in bed and kept perfectly quiet. Children are placed on the side,

Fig. 73.—Elevation of foot of crib in the after-treatment of tonsillectomy.

and the foot of the crib is elevated (Fig. 73). Some operators caution the nurse explicitly in regard to keeping the patient on the right side during the time of

recovery from the anesthetic. This posture prevents, in a measure, the blood, saliva, and vomited material from entering either the lungs or the stomach. The right side is preferable, as it does not impede heart action. Care, however, must be taken that the face does not become imbedded in the mattress, as this has been known to almost cause suffocation. If the right

Fig. 74.—Artificial respiration and position for milking trachea.

arm is drawn under the head it will keep the face sufficiently away from the bed-clothes. These rules should apply for twenty-four hours. No food is given for several hours, when a little cracked ice or cold milk is given. Ice-cream may be given four or five hours after the operation, other things being favorable.

Accidents.—Inhalation of blood-clots, pieces of adenoid or tonsil, excess of anesthesia, and shock.

When any foreign material enters the larynx or trachea the patient should be inverted (Fig. 74) and several forceful slaps on the back made to force the matter out by sudden expulsion of the residual air in the lungs. This failing, the finger should be introduced into the larynx and efforts made to extract the body. Milking the trachea from below upward will sometimes force out blood-clots. Tracheotomy should not be postponed too long if other means fail. In case of excessive anesthesia, oxygen should be given and hypodermic stimulation, together with artificial respiration.

ADENOIDS

They are sometimes present at birth or may appear shortly after. In infants their presence may be determined by mouth-breathing, snuffles, and inability to nurse without frequent interruptions to breathe through the mouth.

Symptoms in children vary in intensity, and in certain cases their presence creates no apparent disturbance. The adenoid tissue lessens as age increases, but if any of the following symptoms persist, it is decidedly unwise to await their reduction by age.

Symptoms in Children.—Mouth-breathing, snoring, running nose, frequent colds, earache, nosebleed, slow development, narrow chest, bad digestion, restless nights, persistent hacking cough, and mental dulness.

In certain cases where the adenoid only gives evidence of its presence when the child has a cold or some digestive disturbance, local and constitutional treatment will prove effective. When the adenoid continues to give the symptoms mentioned, surgical removal is necessary.

Anesthesia is always advisable, although some operators remove adenoids from infants without its use. In infants a whiff of chloroform is all that is necessary. From two to eight years old, ether can be used satisfactorily, and after this, gas followed by ether. It is inadvisable to give young children gas.

CHAPTER XXVI

THE LARYNX

Anatomic Description

The framework of the larynx is made up of the thyroid, cricoid, and the arytenoid cartilages, held together by a dense membrane and numerous muscles (Fig. 75). Above the upper entrance to the larynx is situated the

Fig. 75.—The larynx as seen in the laryngoscopic mirror. The illustration shows the parts larger than normal in order to bring out the details (Fowler).

epiglottis, which remains almost vertical during respiration, but is forced downward upon the top of the larynx during deglutition, thereby preventing food or fluid from entering the larynx.

laryngeal mirrors.

On looking into the larynx from above, one sees two folds of mucous membrane projecting from either side, which are the ventricular bands or false vocal cords. Just below these are two sulci or ventricles, which are the ventricles of the larynx, and below the ventricles are

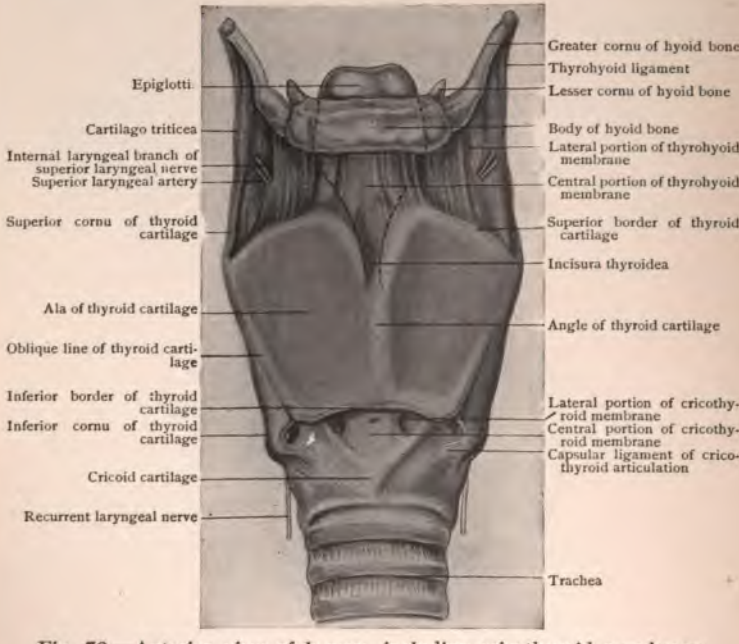


Fig. 76.—Anterior view of larynx, including cricothyroid membrane. (From Deaver's Surgical Anatomy.)

two dense bands of elastic fibrous tissue, pearly white, which are the true vocal cords. These cords are attached anteriorly to the thyroid cartilage and posteriorly to the arytenoid cartilages. Below the larynx and continuous with it is the trachea.

Looking at the larynx from in front, with its muscles

cut away, one sees first the hyoid bone, the body of which marks the entrance to the esophagus behind. Then a membrane between the hyoid bone and the thyroid cartilage, the thyrohyoid membrane.

Next are seen the two large plates of the thyroid cartilage uniting at an acute angle in front; this is known as Adam's apple and is more prominent in men. Then another membrane, cricothyroid, and, lastly, the smaller portion of the cricoid cartilage (Fig. 76).

Speaking and Singing Voice.—The air from the lungs is forced against the vocal cords, which are set in vibration, and the initial sound from them is transmitted to the bones of the head, which act as resonators, and these emit certain tones which are governed in intensity by the force of the air-current and the number of vibrations of the vocal cords.

Examination of the Larynx

This may be accomplished by means of reflected light on a laryngeal mirror or directly by passing a tube into the larynx. Under ordinary circumstances the laryngoscopic mirror is used, but in refractory children and when a foreign body is suspected, the Killian or Jackson laryngoscopic or bronchoscopic tubes are used. These tubes may be used upon the adult under cocain anesthesia, but in children a general anesthetic, preferably chloroform, is necessary. When these tubes are to be used, the nurse should always have ready ample small gauze sponges on long holders, with all fibers removed, adrenalin solution in full strength, and a 10 per cent. solution of cocain.

Edema of the Larynx

Edema of the larynx may occur as a complication of or in the course of any of the infectious diseases, as typhoid, scarlet fever, diphtheria, etc. It may also occur as the result of direct infection in erysipelas, phthisis, or from abscess of the tonsil, base of the tongue, or retropharynx.

Symptoms.—Dyspnea, voice husky at first and subsequently lost. Pain may not be present, but a distinct sense of discomfort is experienced. The face gives evidence of anxiety and the skin is clammy.

Treatment.—Ice externally and internally; adrenalin spray and inhalations of medicated steam. It is frequently necessary for the physician to scarify the larynx or to perform tracheotomy. In every case vigorous purgatives should be administered, as by this means serum is drawn away from the tissues involved.

Benign and Malignant Tumors

If malignant, they may be confused with syphilis or tuberculosis, and microscopic examination of a specimen may be necessary to determine the diagnosis. Whether benign or malignant, surgical intervention is necessary.

Laryngeal Tuberculosis

This condition is ordinarily secondary to tuberculosis elsewhere in the body.

Predisposing Causes.—Exhaustion or long-continued fatigue, mental and physical. Lowered vitality, bad ventilation, poor food, colds, frequent inflammation of the upper air-tract.

Exciting Cause.—The tubercle bacillus.

Symptoms.—Severe pain, particularly on swallowing, cough, usually of an irritating, hacking nature. Loss of weight, night-sweats, hoarseness or loss of voice, shortness of breath, and even difficult respiration upon exertion.

The **diagnosis** is made by the history of the case, the appearance of the larynx, and from the microscopic findings.

Treatment.—If seen early, removal to a high dry climate will in some instances arrest the progress of the disease. Rest of the larynx, neither talking nor whispering. Soothing inhalations, as the mixture of oil of pine, menthol, and milk of magnesia. For the pain, orthoform powders, cocain, and iodoform emulsion, applied locally.

SYPHILIS

It is frequently difficult to determine if a lesion in the larynx is syphilitic, tuberculous, or cancerous. The main points of difference are that in syphilis pain is frequently absent, the ulceration is deeper, the infiltration is greater in extent, and the surrounding tissues are not so anemic. The constitutional symptoms are less pronounced; there is less loss of weight, less cough, a different history, and the microscopic picture may be entirely different.

Treatment.—Here the iodid of potassium with mercury by injections or inunctions begin to produce a favorable change at once. In isolated cases no effect is seen. Local applications of nitrate of silver aids in healing the ulcers.

FOREIGN BODIES

Coins, whistles, safety-pins, etc., frequently lodge in the larynx and produce more or less alarming conditions. Some of these bodies can be extracted by means of suitable forceps and the aid of the laryngoscopic mirror; but very frequently these bodies get too far down to be extracted in this manner, when it becomes necessary to use the Jackson or Killian tubes to aid in their removal. In children a general anesthetic is necessary, preferably chloroform, as this produces less secretion in the larynx. The head of the child is extended over the end of the table, so that the mouth, larynx, and trachea are in a straight line. The head is held in position by the anesthetist, who also keeps the jaws apart by means of an iron thimble on the middle finger.

DOUCHES

The solutions and their strength are determined by the doctor. Douches should be copious, as a large flow does less damage to mucous surfaces than a small one. The Douglass syringe should be used, with the patient seated and the head well flexed on the chest and slightly turned toward the side where the tip is introduced. The patient opens his mouth and continues to breathe, while the flow takes place from one nostril to the other around the septum. The pressure should be gentle and uniform, thus lessening, as far as possible, the danger of forcing the liquid or other matter into the Eustachian tubes. It is also better to introduce the syringe into the opposite side from the operation first, as the discharge and clots are then forced out without endangering the Eustachian tubes or the healthy side. A sufficient

Fig. 77.—Nasal douching with fountain syringe.

Fig. 78.—Nasal douching with fountain syringe with patient reclining.

number of irrigations should be employed to perfectly cleanse the nose, and the water should be hot (110° F.) unless otherwise ordered. This syringe is effective in postoperative work—infected sinuses and atrophic rhinitis.

Fig. 79.—Nasal douching with Douglass syringe.

A douche bag may be employed in like manner if a blunt nasal tip is used in the end of the tube and the nostril held firmly around the tip while irrigating. Should the nurse be requested to irrigate only one nostril, then the tip may be omitted and the solution allowed to flow

from a straight tip or from the tube itself. The bag should be placed about 2 feet above the patient's head unless otherwise ordered.

Irrigation

This term is ordinarily applied to washing out some cavity or sinus. The operator usually performs this

Fig. 80.—Irrigating maxillary sinus.

service himself or, if he does not, will instruct the nurse how it should be done.

Sprays

Those most commonly employed are hand sprays, which are easily manipulated. In spraying the nose, insert the tip just within the vestibule and hold up the

nostril gently on the end of the spray nozzle. In this way easier entrance is obtained for the solution. A very forceful spray is injurious to the nasal mucous membrane and should not be used. The throat can be more vigorously sprayed. It is difficult to spray the larynx without proper instruments. However, some of the solution will ultimately reach the larynx and a nurse is often requested to perform this function for the patient. The spray nozzle should be turned downward and the patient should hold his tongue forward while the tip of the spray is placed far back, but not touching the pharynx, and the patient instructed to take three or four deep inhalations or to say "ah," at which time the spray is worked rather vigorously.

GARGLES

These are manifold and are either hot or cold. The nurse should encourage the patient to prevent the liquid being swallowed or inhaled by continuous exhalation. The gargles should not be too hot.

INHALATIONS

Medicated steam inhalation is a most effective way of allaying inflammation of the mucous membranes, particularly of the larynx. An improvised way of giving an inhalation is to place in a narrow-necked pitcher a pint of boiling water into which is poured the medicated solution. Over the mouth of the pitcher is placed a cornucopia made of pasteboard or oiled paper, with the smaller end turned toward the mouth of the patient, and from which exudes the vapor. A more effective way is to use an earthenware inhaler (Maws), which has

the advantage of holding the heat longer, or another simpler, cheaper inhaler, known as the benzoinal inhaler, which is made of tin and can be placed over an alcohol lamp or on the gas stove, and the solution brought to the boiling-point. The latest improvement in this line is the vacuum inhaler, constructed after the manner of the Thermos Bottle, which retains its heat for a long period. This is especially serviceable in traveling or for use at night, where hot water is not easily obtained. There are many forms of solutions used in hot water. Benzoin, turpentine, eucalyptol, etc., all have their advocates, but are sometimes irritating to delicate mucous membranes. The following mixture is very soothing in croup. laryngitis, tracheotomy cases, and acute colds:

Oleum pini pumilionis	℥j
Menthol	gr. v
Milk of magnesia	℥ij

One dram of the mixture to a pint of boiling water. This same mixture may be used in a croup kettle and should be renewed every three hours.

TRACHEOTOMY

The trachea may have to be opened in an emergency or as a more deliberate procedure. Frequently the condition is so critical that the trachea must be opened without consideration of asepsis or antisepsis and with any instrument at hand. Entrance by means of a pocket knife has saved many lives. In such cases the incision is made through the skin and other tissues directly into the trachea. The incision should be made with the long axis of the trachea, but even a transverse incision is preferable to none.

When tracheotomy is performed without the necessity for haste, more care is exercised. The entire area between the top of the larynx and the sternum should be surgically clean and a bichlorid dressing applied. Chloroform anesthesia is ordinarily employed in these cases, as the secretion is far less excessive than when ether is used. The patient is placed on the back with a sandbag beneath the shoulders, so that the head is partially extended. Local anesthesia is frequently employed in adults, and the same position on the operating table is assumed.

Instruments.—Scalpels (both sharp and probe pointed); scissors (curved and straight, blunt and sharp pointed); artery clamps; forceps; directors; tenacula; small retractors; trachea dilator; catheter; curved needle; strong silk and catgut sutures; tongue forceps; mouth-gag; sponges; and several sizes of long silver tracheotomy tubes fitted with tape.

The silver tubes create less irritation than those made of aluminum or hard rubber. Tracheotomy is performed for any obstruction to respiration which cannot be overcome by other means, whether due to the presence of a tumor, foreign body, or inflammatory process. When it is performed for diphtheria, special care should be exercised by the operator to prevent his becoming infected, for which he should wear a face mask.

After-care.—A piece of gauze wet with 1:5000 bichlorid solution should be kept over the mouth of the tube. The patient should be placed under a tent where a croup kettle is kept boiling with some of the balsams added to the water, preferably the oil of pine mixture (Fig. 81). The tent should permit of no draught, but

offer ample ventilation, and should not be kept so warm that both patient and nurse get a steam bath. The head of the patient should be lowered slightly to prevent the inhalation of blood or mucus. The inner tube should be kept as clean as possible, which in many instances necessitates removal every fifteen minutes or oftener. The nurse should not remove the outer tube

Fig. 81.—Croup tent arranged for tracheotomy case.

nor attempt cleaning the inner tube with cotton on a probe when it is *in situ*, as there is danger of having the cotton slip off and be drawn into the trachea. It is far safer to remove the inner tube for cleansing. The mucus may be swabbed away with gauze, and even strips of gauze may be inserted into the inner and outer tubes to relieve them of mucus; but when this is done one end of the strip should be firmly held in one hand. The

nurse's attention should be directed to the position of the tube, to hemorrhage around the tube, to the patient's breathing, pulse-rate, and temperature. The dangers are pneumonia, shock, displacement of the tube, hemorrhage, and infection of the wound. Should the tube be displaced, the nurse should attempt immediately to replace it, but should this prove difficult, no time should be lost in the endeavor to force the tube into its former place, as this only creates trauma and makes it harder to reinsert subsequently, but she should immediately hold the opening in the trachea apart with forceps, trachea dilator, or any instrument at hand, so that the patient may breathe until the doctor arrives.

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